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POLLUTION OF THE INTERSTATE WATERS OF THE LOWER COLUMBIA RIVER AND THE TRIBUTARIES. BONNEVILLE DAM TO CATHLAMET, WASHINGTON. SESSION (3RD) PROCEEDINGS OF CONFERENCE ON SEPTEMBER 8-9, 1965. VOLUME I

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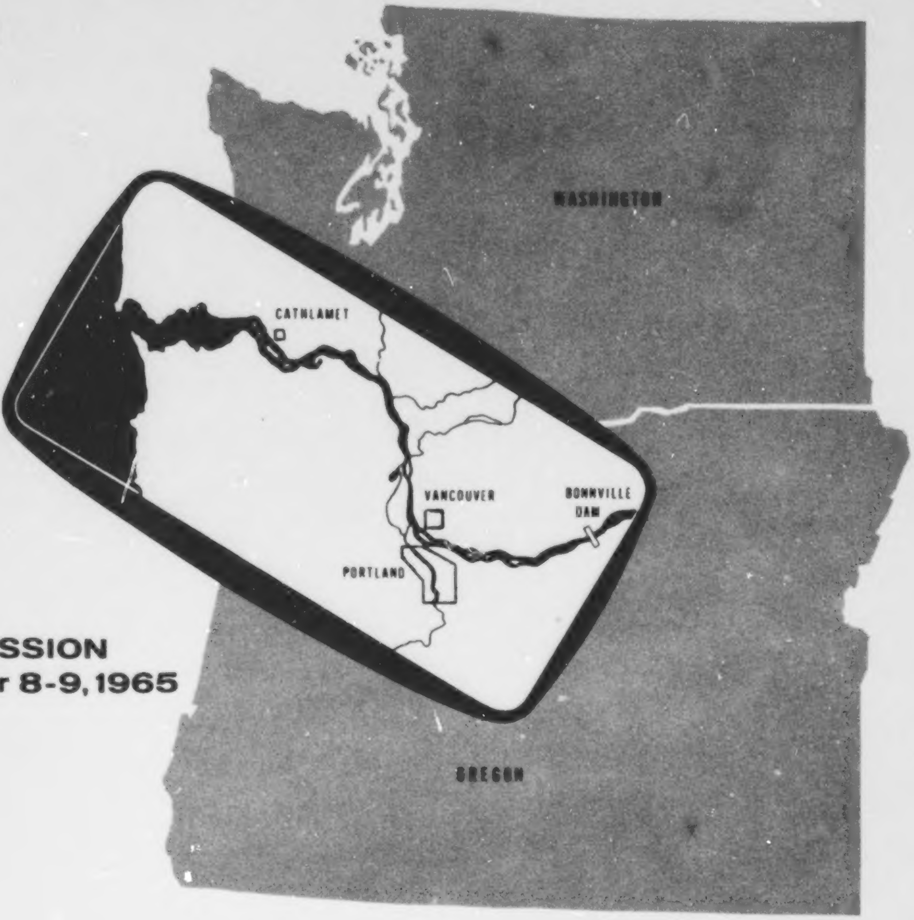
WASHINGTON
CATHLAMET
VANCOUVER
BONNEVILLE DAM
PORTLAND
OREGON

THIRD SESSION
September 8-9, 1965

Conference

In the matter of Pollution of the Interstate Waters of the Lower Columbia River and the Tributaries · Bonneville Dam to Cathlamet, Washington

U. S DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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* * * * *

CONFERENCE ON POLLUTION OF INTERSTATE WATERS

LOWER COLUMBIA RIVER
(Below Bonneville Dam)

Auditorium, Interior Building
Portland, Oregon
September 8, 9, 1965.

CHAIRMAN -- MURRAY STEIN, Chief
Interstate Enforcement
Water Supply and Water Pollution
Control Program
U. S. Public Health Service
Washington, D. C.

CONFEREES:-

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Portland, Oregon 97205

(A list of other attendees is attached as "Appendix A.")

(Whereupon the Conference was convened at 9:40 o'clock, A.M., Wednesday, September 8, 1965, by Chairman Stein, and the following proceedings were had:)

CHAIRMAN STEIN: The conference is open.

This third session of the conference in the matter of pollution of the interstate waters of the Lower Columbia River and its tributaries from Bonneville Dam to Cathlamet, Washington, involving the States of Oregon and Washington, and the Department of Health, Education, and Welfare, is being held under the provisions of section 8 of the Federal Water Pollution Control Act. The Secretary of Health, Education, and Welfare, is required to call a conference of this type, when on the basis of reports, surveys, or studies, he has reason to believe that pollution of interstate waters subject to abatement under the Federal Act is occurring.

The purpose of the conference is to bring together the State water pollution control agencies, the representatives of the Department of Health, Education, and Welfare, and other interested parties to review the existing situation, to appraise what has been done, to lay a basis for future action by all parties concerned, and to give the States, localities, and industries an opportunity to take any remedial action which may be indicated under State and local law.

The conference technique is rather an old one. It is used by many State agencies informally in the normal conduct of their business in the field of water pollution control; and I know both states here, do, in fact, use the informal conference technique with their constituents. The concept of the conference was proposed by the United States Supreme Court as long ago as 1921 in the famous case of New York against New Jersey involving interstate pollution.

I would like to quote from this Court opinion:

> "We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal by the large and growing population living on the shores of New York Bay is one more readily to be most wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceeding in any court however constituted."

We strongly support the conference technique and we measure our success by the situations which are solved at the conference stages, rather than by the court actions we bring.

Under section 8 of the Federal Water Pollution Control Act, the Secretary of Health, Education, and Welfare has notified the official State water pollution control agencies of this conference. These agencies are the Oregon State Board of Health and the Washington State Pollution Control Commission.

Oregon will be represented by Mr. Kenneth Spies; Washington will be represented by Mr. Roy Harris.

Mr. Richard Poston, Department of Health, Education, and Welfare, with headquarters in Portland, Oregon, has been designated as conferee for the Federal Government.

My name is Murray Stein. I am from Washington, D.C., Headquarters of the Department of Health, Education, and Welfare.

The representatives of the official agencies are privileged to bring whomever they wish to the conference and have them participate in the conference. However, this is a conference between the State representatives and the representatives of the Department of Health, Education, and Welfare, and these parties constitute the conferees.

Both the States and the Federal Government have responsibilities in dealing with interstate water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control interstate pollution. It has always been the policy of the Department of Health, Education, and Welfare to give full recognition to this traditional role of the States. The function of the

Department is to encourage the States in these activities. In addition, the Department of Health, Education, and Welfare is charged by law with specific responsibilities in connection with interstate pollution control problems.

The Federal Water Pollution Control Act provides that pollution of interstate waters, whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters, which endangers the health and welfare of persons in a state other than that in which the discharges originate, is subject to abatement.

Two previous sessions of the conference, held in Portland in September, 1958, and September, 1959, considered the interstate pollution as it was then occurring in the Lower Columbia River.

At the second session an Action Program was adopted by the conferees. Standards for water quality in the river were set, and a schedule for the installation of remedial facilities was established as follows:

a. All discharges of domestic sewage were to be provided with effective treatment -- that is, not less than primary treatment plus chlorination, by July 1, 1961.

b. All discharges of industrial waste were to be provided with effective treatment, to include

> both in-plant changes and construction of treatment facilities, by March 1, 1961; with plans for these improvements to be submitted to the appropriate State agency within sixty days.

Since the adoption of the Action Program, good progress has been made in correcting municipal waste discharges in both States. As a result, bacterial pollution in the Lower Columbia is being effectively abated. However, the slime growths in the river, usually attributed to the discharge of organic wastes, have not disappeared.

The Action Program established limits for the discharge of solid materials by municipal or industrial operations, as follows:

> "Floating, suspended, and settleable solids attributable to sewage and industrial waste are limited to that remaining after primary treatment or its equivalent; and which after reasonable dilution and mixture with receiving waters does not cause the formation of sludge beds and does not interfere with the specified legitimate uses."

Further, it is stated in the Action Program with reference to industrial wastes that:

> "Action to control pollution through treatment processes, disposal methods, or equivalent methods will be completed and placed in operation not later

than March 1, 1961."

Reports of Federal investigators indicate that progress to date in the correction of industrial pollution in the Lower Columbia River, with the exception of discharges from grain-washing operations which are now adequately treated, does not comply with the Action Program agreed upon by the conferees.

This third session of the conference, we hope will provide a clear picture of the problem, evaluate what has been done and indicate what remains to be done. Before we leave here we should arrive at an agreement on a plan for correcting the remaining pollution problem.

All the conferees will be called upon to make statements. The conferees, in addition, may call upon participants whom they have invited to the conference to make statements. At the conclusion of such statements, the conferees will be given an opportunity to comment or ask questions, and at the conclusion of the conferees' comments or questions, I may ask a question or two. This procedure has proven effective in the past in developing a clear statement of the problem and in reaching agreements on equitable solutions.

At the end of all the statements, we will have a discussion among the conferees and try to arrive at a basis of agreement on the facts of the situation. Then we will attempt to summarize the conference orally giving the conferees, of course, the right to amend or suggest modifications of the summary.

Under the Federal law, the Secretary is required at the conclusion of the conference to prepare a summary of it which will be sent to all the conferees. The summary, according to law, must include the following:

1. Occurrence of pollution of interstate waters subject to abatement under the Federal Act;
2. Adequacy of measures taken toward abatement of pollution; and
3. Nature of delays, if any, being encountered in abating the pollution.

The Secretary of Health, Education, and Welfare is also required to make recommendations for remedial action if such recommendations are indicated.

Now a word about the procedure governing the conduct of the conference. A record and verbatim transcript will be made of the conference by Mr. Doug Alex. Mr. Alex is making this transcript report for the purpose of aiding us in preparing a summary, and also providing a complete record of what is said here. We will make copies of the summary and transcript available to the official water pollution control agencies of Oregon and Washington. And I should point out that this printed transcript will be in black and

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white. If any of you have color exhibits, they will be reproduced in black and white. We have found that, generally, it is best that people should request transcripts through their State agencies, rather than come directly to the Federal Government. The reason for this is that we would prefer the people who are interested in the problem to follow their normal relationships in dealing with State agencies rather than the Federal Government on these matters when the conference has been concluded. This has worked successfully in the past and we will be most happy to make this material available to the States for distribution.

I would suggest that all speakers and participants other than the conferees making statements come to the lectern and identify themselves for purposes of the record.

At this point we would like to call Mr. Spies for some introductions of members of his board who may be here.

MR. POSTON: Mr. Chairman, I don't believe the audience can hear you. The mikes are off.

(Discussion off the record.)

CHAIRMAN STEIN: Mr. Spies.

MR. SPIES: Mr. Chairman, conferees, ladies and gentlemen: At this time I am very pleased to introduce to you a man who has done more in the field of water pollution control in the state of Oregon than anyone else.

For the past 26 years, he has been Chairman of the

Oregon State Sanitary Authority. During that time, he has given unselfishly of his time and talents to the people of Oregon, to the promotion of clean streams.

I am very pleased at this time to introduce to you Mr. Harold F. Wendel, chairman of the Sanitary Authority. Mr. Wendel may make a statement later in the program. Mr. Wendel. (Applause)

CHAIRMAN STEIN: May we call on Mr. Harris?

MR. HARRIS: Mr. Chairman, fellow conferees, ladies and gentlemen: I believe we have two members of our Washington State Pollution Control Commission present this morning, and at this time I should like to introduce our chairman, Mr. Maurie Ahlquist. Mr. Ahlquist. (Applause)

Earlier in the morning I saw one of the other members of the Commission who is known to most of the people here, John Biggs, a member of the Commission. (Applause)

That will be all, Mr. Chairman.

CHAIRMAN STEIN: Thank you, Mr. Harris. I might add that Mr. John Biggs, as many of you know, has also served a term with distinction on the Federal Water Pollution Control Advisory Board and has made significant contributions to the national program as well as his own state program.

At this point we would like to call on Mr. Richard Poston for the Federal statement; but as Mr. Poston is preparing, I would like to indicate the procedure we will follow for other participants.

Mr. Poston will call on the people for the Federal statement and on all Federal agencies. At that point, we will rest. Under the rules of the conference, we invite people other than the state, Federal agencies. The only other people we invite are the state conferees; the states manage their own time. Therefore, it is suggested during the first recess that people from Oregon who wish to participate get in touch with Mr. Spies. Mr. Spies will call upon you at an appropriate time.

People from Washington should get in touch with Mr. Harris, who will do the same thing.

At this point, we would like to call on Mr. Poston. Mr. Poston.

MR. POSTON: Mr. Chairman, Mr. Spies, Mr. Harris, ladies and gentlemen: At this time I would like to call upon Mr. T. C. Ferris, who is chief of our enforcement activities here in the Pacific Northwest, to make the presentation of the situation as we see it from the Federal angle.

Mr. Ferris.

MR. FERRIS: Thank you, Mr. Poston. Mr. Stein, Mr. Harris, Mr. Spies, ladies and gentlemen:

Today we are concerned with the section of the ----

CHAIRMAN STEIN: Mr. Ferris, is this a condensation of a larger report that you are going to give us?

MR. FERRIS: Yes, sir; this is a summary of the material that is in the report that was available when we registered this morning, the green-covered report.

This is taken from that report, and it's a summary of that material.

CHAIRMAN STEIN: Do you want the complete report to appear in the record?

MR. POSTON: We do.

CHAIRMAN STEIN: Without objection, that will appear as if read; and I think in the interest of time, we might save time if we might go ahead with the summary; continue with reading the summary.

MR. FERRIS: Thank you.

Today we are concerned with the section of the Lower Columbia River from Bonneville Dam to Cathlamet, Washington. This 104-mile reach is more highly developed than any other comparable length of the main river.

For more than 25 years the quality of the waters of the Lower Columbia River has been adversely affected by abundant slime growths which flourish periodically. Materials contained in the wastes discharged along the 80-mile stretch of the river between Camas and Cathlamet supply the nutrients for the slime growths and fiber for attachment of the slime. Commercial fishermen's nets become coated with slime and they must frequently cease fishing or be highly selective in placing their nets to prevent having them swamped with slime. Fishermen report that fibers in the slime become entangled in the knots of their nets making slime removal an extremely difficult operation. Sport fishing and other forms of water-contact recreation have also been adversely affected by the slime growths. I know that many of you in the room have experienced this with your bait lures and the like when you're fishing on the Columbia River. The slime doesn't drop off when you pull it out of the water; it hangs on.

In 1958, a conference in the matter of pollution of the interstate waters of the Lower Columbia River was held under the provisions of Section 8 of the Federal Water Pollution Control Act. The conference was reconvened in 1959 to review progress made during the previous year and to adopt an action program to establish a time schedule of remedial measures. The conferees, who were the Director of the Washington State Pollution Control Commission, the Secretary of the Oregon State Sanitary Authority, and the Assistant Regional Engineer of Region IX, U. S. Public Health Service, concluded that legitimate water uses were endangered by pollution and adopted the following water quality limits to conserve the waters for specified legitimate uses:

"Bacteria: The limit of Coliform bacteria is as follows:

"A representative number of samples should average less than 240 per 100 milliliters and should not exceed this number in more than 20 per cent of the samples examined, when associated with domestic sewage.

"Solid materials discharged by municipal or industrial operations:

The limit of such material is as follows:

"Floating, suspended and settleable solids attributable /to/ sewage and industrial waste are limited to that remaining after primary treatment or its equivalent; and which, after reasonable dilution and mixture with receiving waters, does not cause the formation of sludge beds and does not interfere with specific legitimate uses.

"Slimes: The limit of such material is as follows:

"The presence of Sphaerotilus in such amounts that will /not/ interfere with specific legitimate uses.

"Toxic, colored, or other deleterious substances: The limit of such material is as follows:

"Substances alone or in combination with other substances or wastes, in sufficient amounts or of such nature as /not/ to make receiving waters unsafe or unsuitable for specified legitimate uses."

The following minimum treatment requirements for municipalities and industries were established by the conferees, as a part of an action program to sufficiently reduce pollution to meet the adopted quality limits:

1. All wastes shall receive a minimum of primary treatment or the equivalent thereof.

2. All sewage plant effluents shall be disinfected.

3. Nutrients which support Sphaerotilus growth shall be reduced to acceptable levels.

4. Toxic, colored, or other deleterious substances shall be limited to amounts that will not interfere with other water uses.

At this time, wastes are discharged directly to the Columbia River from ten cities and towns, including the City of Portland; three grain washing plants; two food processing plants; a malting plant; a brewery; and seven pulp and paper mills. The concentrated sulfite waste liquor from one of these seven mills is barged for discharge to the Columbia River during critical dissolved oxygen, high water temperature, and low-flow conditions in the Willamette River.

All of the cities and towns provide primary treatment with effluent disinfection for the wastes discharged directly to the Columbia River. This action by the cities and towns is in compliance with 1959 conference requirements to provide primary treatment and effluent disinfection. Also, a bacteriological survey of the river in the Portland-Vancouver area in September, 1964, showed that the bacterial quality now closely approaches the standards adopted by the 1959 conference. I might say in this respect that there is a publication up on the desk there that gives a brief summary of this bacteriological survey that was undertaken last year, and some of the data from the previous year, but there has been a very marked improvement the last year. While most of the wastes from Portland are treated at the city's plant with effluent discharge to the Columbia, there still remain, within the City of Portland, 27 city-owned and 25 private sewers which discharge untreated wastes to the Willamette River. In 1963 these discharges had a population equivalent of 112,000. During 1964 a number of these sewers were intercepted, and the population equivalent of the untreated discharge is now 28,000. Based on limited information, the wastes discharged to the Willamette River appear to have very little effect on the Columbia River.

All of the industries that discharge wastes to the Columbia River, except the pulp and paper mills, provide treatment which complies with the action program adopted by conferees in 1959. While the pulp and paper mills have made some operational changes to reduce the pollution load, the increase in pulp and paper production since 1959 has resulted in an average daily net increase of approximately 165,000 pounds of biochemical oxygen demand and 55,000 pounds of volatile suspended matter in their waste discharge. Of the 4,798 tons per day of pulp production from the seven mills, 742 tons are produced by the sulfite process with no recovery of the base cooking chemicals; otherwise, all of it is thrown away to the river. Approximately one-half of the average daily biochemical oxygen demand loading to the river from the mills is contained in the sulfite waste liquor from this 742 tons of pulp produced by the sulfite process. One of the sulfite mills constructed a holding lagoon in which most of its wastes are held for six days with discharge on the seventh. This facility did reduce the slime problem for a distance below the mill, but greatly complicated the slime problem further downstream. All seven mills use savealls with the paper machines.

The limited improvements made by the pulp and paper industry do not meet the requirements of the 1959 conference. Primary treatment has not been provided and, while there are no known sludge bed deposits, the large volume of fibrous material does interfere with specified legitimate uses. The nutrients in the pulp and paper mill wastes which support slime growth have not been reduced but show a 27 per cent increase.

The following six graphic illustrations will show the amount and distribution of the waste loadings imposed on the river and the principal reason for the increase in solids and nutrient loadings between 1959 and 1964.

Incidentally, I might mention that all of the illustrations that we will show here, with the exception of three, are on the back wall, in case any of you would like to look at them more closely at a later time.

(At this point, Illustration No. 1 was
projected on the screen.)

This illustration shows the distribution of the biochemical oxygen demand loadings (nutrient material) in both 1959 and 1964 for the municipal and industrial sources. Note that, in 1959, 8 per cent of the load is attributed to the ten cities and towns; that 4 per cent represents the loading from the three grain washing plants, two food processing plants, a malting plant and a brewery; that 88 per cent represents the loading from the seven pulp and paper mills.

The total 1959 loading is 693,065 pounds of biochemical oxygen demand per day with a population equivalent of a city of 4,077,000 persons. In 1964, the relationship is 6 per cent of the loading for the cities and towns, 4 per cent for the industries other than pulp and paper, 90 per cent for the pulp and paper industry. The total is 864,460 pounds of biochemical oxygen demand per day with a population equivalent of a city of 5,085,000 persons. It should be noted that even with the growth of the towns and cities during this period that the loading imposed has decreased about 2,000 pounds per day since 1959. This decrease can be attributed to the improvements which have been made by these industries. It should also be noted that the loading from the pulp and paper industry has increased 165,275 pounds per day which is about twice as much as all other 1964 sources combined.

(At this point, Illustration No. 2 was projected on the screen.)

This illustration shows the distribution of solids loading to the river for 1964.

CHAIRMAN STEIN: Mr. Ferris, how about identifying those illustrations by number? And I would suggest, while we are on this, we all think about this for the record -- something like pointing up there or something in the back, without identifying the title, doesn't mean anything when someone reads this in the printed record some months from now.

So I would suggest we try to keep that in mind; and if you want to call this Illustration No. 2, it will so appear in the printed record, and people will be able to identify it.

MR. FERRIS: Mighty fine. The previous illustration is No. 1; this will be No. 2. There are a series of 11 illustrations.

This is the solids loading, the volatile suspended matter. The data for 1959 was incomplete and for this reason we have not included it on this particular illustration. Note in this illustration that 14 per cent of the loading is attributed to the cities and towns, 2 per cent is from the industries other than pulp and paper, and 84 per cent from the pulp and paper industry. The total loading is 298,760 pounds per day or about 149 tons per day. The solids discharged by the pulp and paper industry are principally wood fibers that decompose at a very slow rate. You will note from this, the previous illustration and this one, that the waste loadings on the Columbia River from this portion of the river is principally all from the pulp and paper industry. The cities and towns and other industries contribute very little to the overall loading.

(At this point, Illustration No. 3 was projected on the screen.)

This is illustration No. 3, which covers the pulp mill production. This illustration shows the level of pulp production by the seven mills in 1959 and 1964. Note that production has increased at all of the mills and that the total increase is 1,022 tons per day. Increased production is the main reason for the additional biochemical oxygen demand and volatile suspended matter waste loadings to the river. It should also be noted that over half the pulp production is in the Longview area, one-fourth in the Camas area, and the remainder divided between St. Helens, Vancouver, and Oregon City. Incidentally, we have lifted these in the way going upstream from Weyerhaeuser, at the lowest point, to Camas as the most further upstream.

(At this point, Illustration No. 4 was projected on the screen.)

This is illustration No. 4, which shows the distribution of paper production by six of the mills in 1959 and 1964. The total increase is 627 tons per day. Kaiser Gypsum production is measured in square feet of soft board, and for this reason is not included in this illustration. Paper production has increased at all of the mills and this increase also contributes to the additional biochemical oxygen demand and volatile suspended matter loadings to the river.

(At this point, Illustration No. 5 was projected on the screen.)

This is illustration No. 5. This illustration shows the distribution of biochemical oxygen demand loading produced by the seven mills for 1959 and 1964. For the three Oregon mills the increase in biochemical oxygen demand was calculated to be proportional to the increase in pulp production since 1959. All of the other reported values were furnished by the mills to the respective State pollution control agencies. The biochemical oxygen demand loading produced has increased for each of the mills and can be attributed to the increase in production. You will note that the '59 BOD are shown in the large, darker blue; '64 loads are in the lighter blue color.

CHAIRMAN STEIN: How does this show on the chart, or will it show? Again, please do not refer, if we can avoid it, to color references, because they are meaningless when we have the transcript.

MR. FERRIS: My apologies. Can we delete that part?

It should be noted that over 40 per cent of the biochemical oxygen demand loading is from the Camas mill, and, while they can store 280,000 pounds of biochemical oxygen demand per day for six days and discharge 1,960,000 pounds on the seventh, the overall loading to the river is not changed. It is also interesting to note that the Boise-Cascade plant at Vancouver is about the third largest producer of biochemical oxygen demand, and yet on the previous slide, they're one of the smallest pulp producers of these particular mills in this section of the River.

(At this point, Illustration No. 6 was projected on the screen.)

This illustration shows the distribution of volatile suspended solids discharged to the river on a daily basis. These solids are principally fibrous material which decomposes very slowly with the result that there is a progressive increase in fiber concentration below each discharge location.

It can be seen from this series of illustrations that the waste loading imposed by the pulp and paper industry has increased considerably since 1959. The industry's efforts to decrease waste loadings have not been sufficient to reduce the fiber and slime problems in this section of the river.

Previous and current investigations have found that the wastes from the seven pulp and paper mills are the principal source of the nutrient material required for slime growth. While previous investigators believed that slime grew on fixed surfaces and broke loose to foul fishermen's nets, the review of German literature substantiated by investigations on the Columbia River, has shown that the fibers in these wastes serve as a substrate for the growth of slime. Furthermore, the presence of fiber in the Columbia River severely complicates the problem of slime removal from nets. Laboratory studies have indicated that slime will grow when the sulfite waste liquor concentration is as low as 20 to 50 parts per million (based on 10 per cent solids basis) but the growth is lessened at lower concentrations. However, stream studies have shown excellent growth at concentrations as low as 10 to 20 parts per million (10 per cent solids basis). One of the previous investigators reported that the optimum temperature range for slime growth was 10 to 15 degrees centigrade.

Late in 1960 a reporting program was initiated in cooperation with commercial fishermen to gather more information on the frequency of occurrence and severity of the slime problem. Reports of slime occurrence at drifts were received during a discharge range of 81,600 to 437,130 cubic feet per second and a temperature range of 5.6 to 21.1 degrees centigrade. I might explain -- I'm sure most of your fishermen's drifts are in an area in which each fisherman is assigned or in an area which he owns or leases, which he fishes commercially on the river. Each one of them have a designation as a named drift. The most severe condition occurred when river discharge ranged from 184,200 to 235,390 cubic feet per second and temperature ranged from 10 to 12 degrees centigrade. These reports indicate the severity of slimes frequently increased during the passage of the intermittent waste discharge from the Crown Zellerbach pulp mill's wasteholding lagoon.

In 1963 and 1964 the worst slime conditions existed during the first week of May when the 1963 flow was 210,000 cubic feet per second and the temperature 10.6 degrees centigrade, and 167,000 cubic feet per second and 10.5 degrees centigrade in 1964. A severe condition did not occur in 1965, because the river flow was 410,000 cubic feet per second even though the temperature was 11 degrees centigrade. Note that the flow in 1965 was about twice as large as in 1963 and 1964. Slime did occur at other times during these three years. The following three illustrations show the periods when slime conditions were reported by the fishermen.

(At this point, Illustration No. 7 was projected on the screen.)

This will be illustration No. 7. One of the lines depict the flow recorded at Bonneville Dam; one of the other lines -- I can't refer to color -- depicts the temperature recorded at Bonneville Dam. By taking the fishermen's report and record when slime conditions were encountered, we were able to mark them on this particular graph, and they are indicated by the word "slime." Otherwise, this doesn't denote the severity, but slime was encountered by the fishermen. And on the bottom of the chart, you will note that the commercial fishing seasons are designated. This is one thing to keep in mind. The commercial fishermen don't fish all year. They have a specified fishing season. So for recording purposes, you only receive them during the fishing season.

There is one exception, that during snagging operations, just previous to the season, they will run into slime and do record it at that time.

In this illustration for 1963, you will note that the slime is recorded in May when the flow was around 230,000 cubic feet per second and the temperature 10 to 15 degrees centigrade, in late July and August when the flow is around 180,000 cubic feet per second and the temperature 15 - 20 degrees centigrade, and again in September and October when the flow is less than 120,000 cubic feet per second and the temperature around 20 degrees centigrade.

(At this point, Illustration No. 8 was projected on the screen.)

This will be illustration No. 8, which is similar to the previous one, but for 1964. This illustration for 1964 shows that slime was reported in February, April, and May when the flow was less than 150,000 cubic feet per second and the temperature 10 - 15 degrees centigrade, and again in September and October when the flow was less than 150,000 cubic feet per second and the temperature was 15 - 20 degrees centigrade. It will be noted fishermen reported slime conditions during snagging of their drifts prior to the opening of the regular fishing season.

(At this point, Illustration No. 9 was
projected on the screen.)

This is illustration No. 9. In 1965 a small amount of slime was noted in May with the flow above 400,000 cubic feet per second and the temperature above 10 degrees centigrade. Slime conditions became worse in August when the flow was less than 200,000 cubic feet per second and the temperature was around 20 degrees centigrade.

The following conclusions are based on observations and recorded river conditions:

1. Slime interferes with commercial and sport fishing by fouling nets and gear.

2. The wastes from the pulp and paper industry are primarily responsible for this problem. The additional wastes resulting from increased production since 1959 have compounded the problem.

3. Wood fibers add strength and body to the slimes and make them more difficult to remove from nets and sport fishing gear. These fibers are discharged along with the dissolved organic wastes from the pulp and paper mills from Camas to Longview. There is no fiber problem above Camas. Fiber decomposition is so slow that with existing river flows the increment of fibers from each successive waste discharge increases the downstream concentration.

4. The action program for the Lower Columbia

River Conference adopted September 3, 1959, called for a minimum of primary treatment or its equivalent for all wastes discharged to the river. The 248,000 pounds per day of volatile suspended matter presently discharged to the river are essentially all wood fibers which are not being satisfactorily assimilated, and primary treatment for the removal of these fibers is needed now.

5. Pulp production has increased from 3,776 tons per day to 4,798 tons per day since 1959. As a result, the average loading to the river has increased from 613,000 to 778,000 pounds biochemical oxygen demand per day. The daily organic load imposed by this industry is nearly six times as great as that from all other sources combined, and this is increased to more than 28 times during the once-a-week discharge from the one holding pond.

6. Nearly half of the average daily biochemical oxygen demand loading is contributed by three mills using the sulfite process with no recovery of the base cooking chemicals.

7. A slime concentration that severely interferes with commercial and sport fishing develops when the river flow is less than 220,000 cubic feet per second (at Mayger) and the water temperature is 10 degrees centigrade to 15 degrees centigrade.

8. Slimes which interfere with fishing between

Camas and Vancouver occur only during the passage of the once-a-week waste discharge from the Camas mill. With critical flow and temperature conditions, the stored load of 1,960,000 pounds of biochemical oxygen demand discharged in a 24-hour period compounds the slime problem downstream, particularly in the Mayger area. The intermittent waste discharge program has not proved successful.

9. The major part of the slime develops on, and becomes entangled with, wood fibers and other debris in the river rather than on the streambed as was previously believed. The results of the 1964 sampling program show that slime does grow on suspended debris, as reported in the German literature.

10. Most of the objectionable wood fibers contained in mill wastes can be removed by primary treatment. The total organic loading to the river, as measured by biochemical oxygen demand, can be decreased about 40 per cent by reduction in waste loadings from spent sulfite liquor discharged to the river at the Camas and Vancouver mills and the total elimination of barged spent sulfite liquor discharged to the Columbia River.

11. Sufficient progress has not been made by the pulp and paper industry to comply with the pollution abatement program adopted by the 1959 conference.

Sewage and industrial wastes discharged to the Lower

Columbia River cause pollution in the interstate waters of the Columbia River which endangers the health or welfare of persons in Oregon and Washington and, therefore, is subject to abatement under the provisions of the Federal Water Pollution Control Act.

A new slime reporting program was initiated in 1965 in cooperation with the Oregon State Sanitary Authority and the Washington State Pollution Control Commission. This program has provided both uniform reporting of the severity of slime encountered and greater details as to time and location of the slime occurrences for the commercial drifts from above Camas to below Mayger. Also, a chemical and biological sampling program has been accomplished during the year. Chemical samples were collected for chemical oxygen demand, sulfite waste liquor, nitrates, and sugar determinations. Temperatures and pH were also recorded. Biological samples were collected with the same type of pumping equipment used during 1964.

RECOMMENDATIONS

Fiber and soluble organic material contribute to the damaging slime problem in the Columbia River. By far the greatest amounts of both causative agents are contained in pulp and paper mill wastes discharged to the river. A waste control and treatment program for pulp and paper wastes discharged to the Columbia River is reasonable and attainable. To obtain progressive and continuing correction of this problem, the following waste control and treatment measures are recommended:

1. As a first step, all pulp and paper mills discharging wastes to the Columbia River should initiate the design and construction of mechanically cleaned primary treatment facilities for mill wastes. Such facilities should accomplish at least a 70 per cent reduction in volatile suspended matter discharged in untreated effluent. Volatile suspended matter discharged per day should not exceed the following values -- incidentally, these values are referred to in the table No. 1 in the report, but I will read them here:

Weyerhaeuser Co., Longview	17,700 pounds volatile suspended matter per day
Longview Fibre, Longview	14,300 pounds volatile suspended matter per day
Boise Cascade, St. Helens	10,800 pounds volatile suspended matter per day
Kaiser Gypsum, St. Helens	2,300 pounds volatile suspended matter per day

Publishers Paper, Oregon City. We recommended discontinuing of the barging to the Columbia River.

Boise Cascade, Vancouver	4,900 pounds volatile suspended matter per day
Crown Zellerbach, Camas	24,500 pounds volatile suspended matter per day.

Adequate facilities for the disposal of recovered solids or sludge should also be provided. These new facilities to be provided at all of the mills should be completed and placed in operation no later than July 1, 1967.

(At this point, Illustration No. 10 was projected on the screen.)

This illustration is No. 10, This illustration shows the 1964 volatile suspended matter loading to the river and the maximum allowable volatile suspended matter loading for each of the mills after the construction of primary treatment facilities. Note that the total loading for all the mills will be reduced 70% from 248,100 to 74,500 pounds per day.

2. Over half of the calculated biochemical oxygen demand loading discharged to the Columbia River by the pulp and paper industry is contained in spent sulfite waste liquor discharged to the river at Camas and Vancouver, Washington, and that barged to the Columbia River from Oregon City, Oregon. A second progressive step to reduce waste loadings to the river will consist of a 70 per cent reduction in biochemical oxygen demand loadings derived from sulfite waste liquor discharged at Camas and Vancouver, and elimination of liquor solids now barged to the Columbia River. The design of these remedial facilities should be completed by July 1, 1965, and the construction should be completed no later than December 31, 1967.

CHAIRMAN STEIN: You mean July 1, 1966, don't you?

MR. FERRIS: I stand corrected. July 1, 1966. That was the design date.

Recommendation No. 3. The remaining pollutional load reaching the river from the pulp and paper industry will consist of residual wastes from the several pulp and paper processes employed by individual mills located along this reach of the Columbia River. A continuing program of waste control will involve, in addition, the following:

a. Waste loadings for the individual mills should not exceed the following limits: These limits are also given in Table 1 in the report, but I will read them here.

Weyerhaeuser Company: 127,500 pounds of biochemical oxygen demands per day.

Longview Fibre: 68,000 pounds of biochemical oxygen demands per day.

Boise-Cascade at St. Helens, 19,760 pounds of biochemical oxygen demands per day.

Kaiser Gypsum, St. Helens, 5,970 pounds of biochemical oxygen demands per day.

Publishers Paper, none, as it's recommended that the barging be discontinued.

Boise-Cascade at Vancouver, 40,800 pounds of biochemical oxygen demands per day.

Crown Zellerbach, Camas, 144,500 pounds of biochemical oxygen demands per day.

Crown Zellerbach, Camas, 144,500 pounds of biochemical oxygen demands per day. This is a total of 406,530.

(At this point, Illustration No. 11 was projected on the screen.)

This illustration shows the existing biochemical oxygen demand loadings for each of the mills and the loading to the river following the 70 per cent reduction in biochemical oxygen demand derived from sulfite liquor discharged at Camas and Vancouver and the 15 per cent reduction in biochemical oxygen demand accomplished with primary treatment. Only by establishing a maximum limit for biochemical oxygen demand loadings to the stream can the effectiveness of the recommended program be measured after the remedial measures in Recommendations 1 and 2 above have been completed.

b. Additional wastes due to industrial expansion should be accompanied by provision for solids reduction, and a compensating degree of biological treatment, or other disposal means, to prevent exceeding the above recommended waste loadings.

c. Should the recommended measures contained in 1 and 2 above prove inadequate to prevent the development of objectionable slime growths in the Columbia River, then biological oxidation or other equally effective means will be necessary. It is our opinion that the dilution of these pulp and paper mills has not proved satisfactory, and the treatment of these wastes is needed and it's needed now.

We wish to acknowledge the assistance of the Oregon State Sanitary Authority and the Washington State Pollution Control Commission for their cooperation in the field studies and for supplying much of the information used in the preparation of the report. Particular acknowledgement is made to Mr. Robert McHugh, Aquatic Biologist, with the Oregon State Sanitary Authority for his review of the literature, particularly his translation of the German literature, and his observations of river conditions.

I might mention on the translation -- and reference is made to it in the report -- that we have written for clearance to print Mr. McHugh's translation. We haven't received it as yet; but if any of you are interested in having a copy of the translation of this German publication as part of the translation, if you will leave your name either with Miss Roton or Mr. Mosbaugh or Mr. Young at the desk, we will be glad to mail you one when we finally get clearance on it.

We thank you.

CHAIRMAN STEIN: Thank you, Mr. Ferris, for a very precise report.

Are there any comments or questions from the conferees? Mr. Spies.

MR. SPIES: I have a question, Mr. Chairman. In connection with Recomendation 3b, Mr. Ferris, where you specify that the loads for each mill shall be kept at predetermined figure, after they have effected the degree of treatment that you have recommended, what would be your recommendation for a new mill that might be located on the river? Does this mean that that mill would have to reduce its load to zero in order to maintain the total load on the river at the figure you have given?

MR. FERRIS: Well, this would depend on a number of details. In this particular reference, as I expressed, by holding the mills -- I mean, holding the loadings at these designated figures, this is the only way you can evaluate the effectiveness of the program.

Now, this would be a new subject and it would have to be evaluated and determined.

I don't have any offhand answer right now.

MR. SPIES: Well, my reason for asking that, of course, is due to the fact that a new mill is presently under construction in Oregon and will be discharging treated wastes into this section of the Lower Columbia River.

MR. FERRIS: Well, in that particular case, we do have these that we are concerned with here, are from Camas to Longview; the one you have reference to will be below that point. So as I would see it, you could evaluate the effectiveness of this program and still have that mill.

MR. SPIES: Thank you.

CHAIRMAN STEIN: Are there any further questions or comments?

I have one which may be largely for clarification. You point out that there still remain within Portland 27 city-owned and 25 private sewers discharging untreated wastes to the Willamette River. Then you said during 1964, a number of these sewers were intercepted.

Do you know how many?

MR. FERRIS: I do not have the details to that, but I feel reasonably sure Mr. Spies or some of his people will give you more specific data on this. I obtain this information from them, and I am sure they are more versed on this than I am.

CHAIRMAN STEIN: If this is possible, that might be an idea, because I think your report is very, very precise, and this is the only area where you have made just a generalized statement.

I do think, perhaps, that if we are dealing with numbers of sewers, and this was raised in them, I think that should be available, if possible.

Are there any further comments or questions? If not, thank you very much, Mr. Ferris.

(Whereupon the complete report referred to on page 12 appears as follows in its entirety:)

"POLLUTION OF INTERSTATE WATERS
OF THE
LOWER COLUMBIA RIVER

BONNEVILLE DAM TO CATHLAMET, WASHINGTON

AUGUST 1965

Division of Water Supply & Pollution Control
U. S. Public Health Service
Portland, Oregon

A Report

POLLUTION OF INTERSTATE WATERS
OF THE
LOWER COLUMBIA RIVER
BONNEVILLE DAM TO CATHLAMET, WASHINGTON

U. S. Department of Health, Education, and Welfare
Public Health Service
Water Supply and Pollution Control Program, Pacific Northwest
Region IX, Portland, Oregon

August 1965

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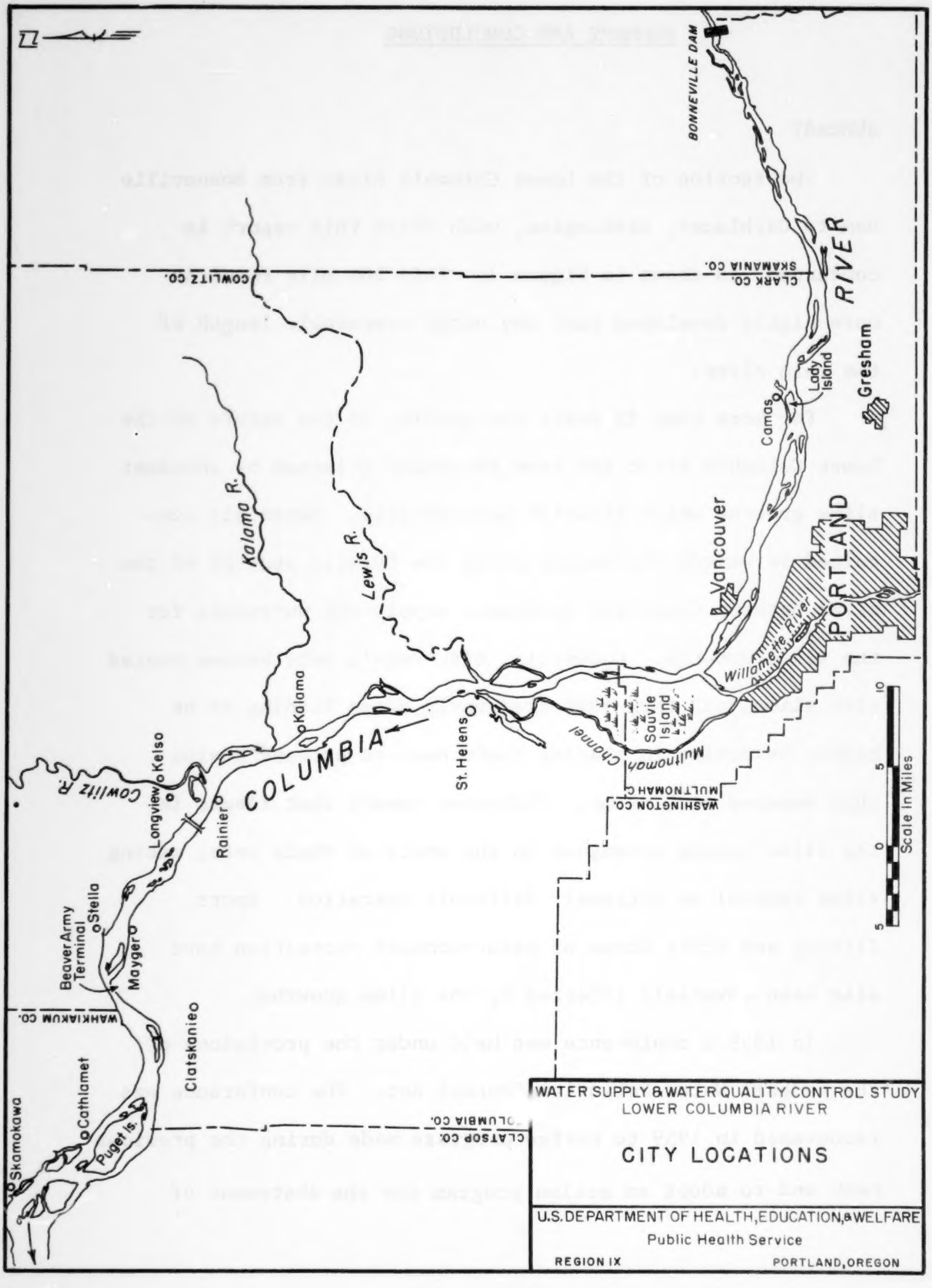
BONNEVILLE DAM
SKAMANIA CO.
CLARK CO.
COWLITZ CO.
RIVER
Lady Island
Gresham
Camas
Vancouver
PORTLAND
Willamette River
Kalama R.
Lewis R.
Kalama
St. Helens
Sauvie Island
Multnomah Channel
MULTNOMAH CO.
WASHINGTON CO.
COLUMBIA
Kelso
Longview
Cowlitz R.
Rainier
Stella
Beaver Army Terminal
Mayger
WAHKIAKUM CO.
Clatskanie
Cathlamet
Skamokawa
Puget Is.
COLUMBIA CO.
CLATSOP CO.
Scale In Miles
5
0
5
10

WATER SUPPLY & WATER QUALITY CONTROL STUDY
LOWER COLUMBIA RIVER

CITY LOCATIONS

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Public Health Service
REGION IX PORTLAND, OREGON

SUMMARY AND CONCLUSIONS

SUMMARY

The section of the Lower Columbia River from Bonneville Dam to Cathlamet, Washington, with which this report is concerned, is shown in Figure I. This 104 mile reach is more highly developed than any other comparable length of the main river.

For more than 25 years the quality of the waters of the Lower Columbia River has been adversely affected by abundant slime growths which flourish periodically. Materials contained in wastes discharged along the 80-mile stretch of the river between Camas and Cathlamet supply the nutrients for the slime growths. Commercial fishermen's nets become coated with slime, and they must frequently cease fishing or be highly selective in placing their nets to prevent having them swamped with slime. Fishermen report that fibers in the slime become entangled in the knots of their nets, making slime removal an extremely difficult operation. Sport fishing and other forms of water-contact recreation have also been adversely affected by the slime growths.

In 1958 a conference was held under the provisions of the Federal Water Pollution Control Act. The conference was reconvened in 1959 to review progress made during the previous year and to adopt an action program for the abatement of pollution.

Wastes are discharged directly to the Columbia River from ten cities and towns, including the City of Portland; three grain washing plants; two food-processing plants; a malting plant; a brewery; and seven pulp and paper mills. The concentrated sulfite waste liquor from one of these seven mills is barged for discharge to the Columbia River during critical oxygen and low-flow conditions in the Willamette River. These sources represent an average daily waste discharge of about 865,000 pounds of Biochemical Oxygen Demand (BOD) and 300,000 pounds of Volatile Suspended Matter (VSM). Of these, approximately 780,000 pounds of BOD and 250,000 pounds of VSM are derived from pulp and paper mill operations.

All of the cities and towns provide primary treatment with effluent disinfection for the wastes discharged directly to the Columbia River. Within the City of Portland there remain 27 city-owned and 25 private sewers which discharge untreated wastes to the Willamette River. Based on limited information, the wastes discharged to the Willamette River appear to have very little effect on the Columbia River. The longer flow period in the lower portion of the Willamette allows time for the stabilization of most of the wastes before they reach the Columbia. The effect of these wastes would be increased when flood conditions exist only on the Willamette River.

All of the industries that discharge wastes to the Columbia River, except the pulp and paper mills, provide treatment which complies with the action program adopted by conferees in 1959. While the pulp and paper mills have made some operational changes to reduce the pollution load, the 1,022 tons/day increase in pulp production and 627 tons/day increase in paper production since 1959 have resulted in an average daily net increase of approximately 165,000 pounds of BOD and 55,000 pounds of VSM in their waste discharge. Of the 4,798 tons/day of pulp production from the seven mills, 742 tons are produced by the sulfite process with no recovery of the base cooking chemicals. Approximately one-half of the average daily BOD loading to the river from the mills is contained in spent sulfite liquor from the 742 tons of pulp produced by the sulfite process. One of the sulfite mills constructed a holding lagoon in which most of its wastes are held for six days, with discharge on the seventh day. This facility did reduce slime growths for a distance below the mill, but greatly complicated the slime problem further downstream. All seven mills use savealls with the paper machines.

Previous and current investigations have revealed that the wastes from the seven pulp and paper mills are the principal source of the nutrient material required for slime growth. While previous investigators believed the slime grew on fixed surfaces and broke loose to foul fishermen's nets, the review of German literature, substantiated by investigations on the Columbia River, has shown that the fibers in these wastes serve as a substrate for the growth of slime. Furthermore, the presence of fiber in the Columbia River severely complicates the problem of slime removal from nets. Laboratory studies have indicated that slime will grow when the spent sulfite solids concentration is as low as 20 to 50 parts per million (ppm) (based on 10 per cent solids), but the growth is lessened at the lower concentrations. However, stream studies have shown excellent growth at concentrations as low as 10 to 20 ppm (10 per cent solids basis). Also, one of the previous investigators reported that the optimum temperature range for slime growth was 10° C. to 15° C.

Late in 1960, a reporting program was initiated in cooperation with commercial fishermen to gather more information on the frequency of occurrence and severity of the slime problem. Reports of slime occurrence at drifts were received during a discharge range of 81,600 cubic feet per second (cfs) to 437,130 cfs and a temperature range of 5.6° C. to 21.1° C. The most severe condition occurred when river discharge ranged from 184,200 to 235,390 cfs and temperature ranged from 10° C. to 12° C. These reports indicate the severity of slimes frequently increased during the passage of the intermittent waste discharge from the Crown Zellerbach pulp mill's waste-holding lagoon.

A waste control and treatment program for pulp and paper wastes discharged to the Columbia River is reasonable and attainable. Primary treatment to remove 70 per cent of the VSM will greatly reduce the amount of objectionable fiber in the river. The barging of spent sulfite liquor to the Columbia River should be discontinued. Mills at Camas and Vancouver should provide the necessary means to obtain a 70 per cent reduction in the BOD loading presently discharged in spent sulfite liquor.

Table I shows the total VSM and BOD loadings presently discharged to the river by each of the seven mills. These reported values were furnished by the mills to the respective State pollution control agencies. Table I also shows the calculated loadings that would remain following the installation of primary treatment at all of the mills and the remaining BOD loading after the 70 per cent reduction in loadings from spent sulfite liquor. The residual BOD loading can be further reduced by biological treatment, or other disposal means should this prove necessary.

CONCLUSIONS

The following conclusions are based on observations and recorded river conditions:

TABLE I

COLUMBIA RIVER - CAMAS TO LONGVIEW, WASHINGTON
PULP AND PAPER INDUSTRY
UNTREATED AND RECOMMENDED WASTE LOADINGS

	Pounds Volatile Suspended Matter/Day 1/		Pounds 5 day BOD/Day		
	Reported Discharge	With Primary Treatment	Reported Discharge	With 70% SWL-BOD Removed	With 15% Reduction by Primary Treatment
Crown Zellerbach Camas, Wash.	81,700	24,500	325,000	170,000 2/	144,500
Boise Cascade Vancouver, Wash.	16,200	4,900	133,000	48,000 2/	40,800
Publishers Paper Oregon City, Oregon	No Report	- -	60,000	Barging to be discontinued	
Kaiser Gypsum St. Helens, Oregon	8,575 7,700 3/	2,300	7,025	7,025	5,970
Boise Cascade St. Helens, Oregon	40,100 36,100 3/	10,800	23,250	23,250	19,760
Longview Fiber Longview, Wash.	47,500	14,300	80,000	80,000	68,000
Weyerhaeuser Co. Longview, Wash.	59,000	17,700	150,000	150,000	127,500
Totals- - - - - - - - -	248,100	74,500	778,275	478,275	406,530
% Reduction - - - - - -		70%		39%	48%
Population Equivalent 4/			4,578,000	2,813,000	2,391,000

1/ VSM as determined by American Public Health Association (APHA) standard methods.
2/ Adjusted on calculated total B.O.D. produced.
3/ Volatile suspended matter assumed 90% of total suspended matter.
4/ Based on 0.17 lbs. BOD/capita/day.

1. Slime interferes with commercial and sport fishing by fouling nets and gear.

2. The wastes from the pulp and paper industry are primarily responsible for this problem. The additional wastes resulting from increased production since 1959 have compounded the problem.

3. Wood fibers add strength and body to the slimes and make them more difficult to remove from nets and sport fishing gear. These fibers are discharged along with the dissolved organic wastes from the pulp and paper mills from Camas to Longview. There is no fiber problem above Camas. Fiber decomposition is so slow that with existing river flows the increment of fibers from each successive waste discharge increases the downstream concentration.

4. The action program for the Lower Columbia River Conference adopted September 3, 1959, called for a minimum of primary sedimentation or its equivalent for all wastes discharged to the river. The 248,000 pounds/day of VSM presently discharged to the river are essentially all wood fibers which are not being satisfactorily assimilated, and primary treatment for the removal of these fibers is needed now.

5. Pulp production has increased from 3,776 tons /day to 4,798 tons/day since 1959. As a result, the average loading to the river has increased from 613,000 to 778,000

pounds BOD/day.* The daily organic load imposed by this industry is nearly six times as great as that from all other sources combined, and this is increased to more than 28 times during the once-a-week discharge from the one holding pond.

6. Nearly half of the average daily BOD loading is contributed by three mills using the sulfite process with no recovery of the base cooking chemicals.

7. A slime concentration that severely interferes with commercial and sport fishing develops when the river flow is less than 220,000 cfs (at Mayger) and the water temperature is 10° to 15° C.

8. Slimes which interfere with fishing between Camas and Vancouver occur only during the passage of the once-a-week waste discharge from Lady Island. With critical flow and temperature conditions, the stored load of 1,960,000 pounds of BOD discharged in a 24-hour period compounds the slime problem downstream, particularly in the Mayger area. The intermittent waste discharge program has not proved successful.

9. The major part of the slime develops on, and becomes entangled with, wood fibers and other debris in the

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*That portion of the BOD increase for the three Oregon mills has been calculated to be proportional to the increase in their pulp production.

river rather than on the streambed as was previously believed. The results of the 1964 sampling program show that slime does grow on suspended debris, as reported in the German literature.

10. Most of the objectionable wood fibers contained in mill wastes can be removed by primary treatment. The total organic loading to the river, as measured by BOD, can be decreased about 40 per cent by reduction in waste loadings from spent sulfite liquor discharged to the river at the Camas and Vancouver mills and the total elimination of barged spent sulfite liquor discharged to the Columbia River.

11. Sufficient progress has not been made by the pulp and paper industry to comply with the pollution abatement program adopted by the 1959 conference.

****

Sewage and industrial wastes discharged to the Lower Columbia River cause pollution in the interstate waters of the Columbia River which endangers the health or welfare of persons in Oregon and Washington and, therefore, is subject to abatement under the provisions of the Federal Water Pollution Control Act.

RECOMMENDATIONS

Fiber and soluble organic material contribute to the damaging slime problem in the Columbia River. By far the greatest amounts of both causative agents are contained in pulp and paper mill wastes discharged to the river. To obtain progressive and continuing correction of this problem, the following waste control and treatment measures are recommended:

1. As a first step, all pulp and paper mills discharging wastes to the Columbia River should initiate the design and construction of mechanically cleaned primary treatment facilities for mill wastes. Such facilities should accomplish at least a 70 per cent reduction in volatile suspended matter discharged in untreated effluent. Volatile suspended matter discharged per day should not exceed those values shown in the column headed " . . .With Primary Treatment" in Table I. Adequate facilities for the disposal of recovered solids or sludge should also be provided. These new facilities to be provided at all of the mills should be completed and placed in operation no later than July 1, 1967.

2. Over half of the calculated BOD loading discharged to the Columbia River by the pulp and paper industry is contained in spent sulfite liquor discharged to the river at Camas and Vancouver, Washington, and that barged to the

Columbia River from Oregon City, Oregon. A second progressive step to reduce waste loadings to the river will consist of a 70 per cent reduction in BOD loadings derived from sulfite liquor discharged at Camas and Vancouver, and elimination of liquor solids now barged to the Columbia River. The design of these remedial facilities should be completed by July 1, 1966, and the construction should be completed no later than December 31, 1967.

3. The remaining pollutional load reaching the river from the pulp and paper industry will consist of residual wastes from the several pulp and paper processes employed by individual mills located along this reach of the Columbia River. A continuing program of waste control will involve, in addition, the following:

a. Waste loadings, as shown in the last column of Table I, for individual mills should not be exceeded.

b. Additional wastes due to industrial expansion should be accompanied by provision for solids reduction, and a compensating degree of biological treatment, or other disposal means, to prevent exceeding the above recommended waste loadings.

c. Should the recommended measures contained in 1 and 2 above prove inadequate to prevent the development of objectionable slime growths in the Columbia River, then biological oxidation or other equally effective means will be necessary.

INTRODUCTION

In 1958, a conference (1) in the matter of pollution of the interstate waters of the Lower Columbia River was held under the provisions of Section 8 of the Federal Water Pollution Control Act. The conference was reconvened in 1959 to review progress made during the previous year and to adopt an action program (2) to establish a time schedule of remedial measures. The conferees, who were the Director of the Washington State Pollution Control Commission, the Secretary of the Oregon State Sanitary Authority, and the Assistant Regional Engineer (Region IX) of the U. S. Public Health Service, concluded that legitimate water uses were endangered by pollution and adopted the following water quality limits to conserve the waters for specified legitimate uses.

> "Bacteria (Coliform): The limit of Coliform bacteria is as follows:
>
> > "A representative number of samples should average less than 240 per 100 milliliters and should not exceed this number in more than 20 percent of samples examined, when associated with domestic sewage.
>
> "Solid materials discharged by municipal or industrial operations: The limit of such material is as

follows:

"Floating, suspended, and settleable solids attributable /to/ sewage and industrial waste are limited to that remaining after primary treatment or its equivalent; and which, after reasonable dilution and mixture with receiving waters, does not cause the formation of sludge beds and does not interfere with the specified legitimate uses.

"Slimes: The limit of such material is as follows:

'The presence of Sphaerotilus in such amounts that will /not/ interfere with specified legitimate uses.

"Toxic, colored, or other deleterious substances: The limit of such material is as follows:

'Substances alone or in combination with other substances or wastes, in sufficient amounts or of such nature as /not/ to make receiving waters unsafe or unsuitable for specified legitimate uses.'

The following minimum treatment requirements for municipalities and industries were established by the conferees, as a part of an action program to sufficiently reduce pollution to meet the adopted quality limits:

1. All wastes shall receive a minimum of primary treatment or the equivalent thereof.

2. All sewage plant effluents shall be disinfected.

3. Nutrients which support Sphaerotilus growth

shall be reduced to acceptable levels.

4. Toxic, colored, or other deleterious substances shall be limited to amounts that will not interfere with other water uses.

A Technical Coordinating Committee, consisting of a representative from the Oregon State Sanitary Authority, the Washington State Pollution Control Commission, and the U. S. Public Health Service, was formed to implement an action program adopted by the conferees. It is the responsibility of this group to formulate plans for joint studies, to evaluate and recommend acceptance or rejection by the regulatory agencies of proposals for corrective measures, and to exchange technical information. Personnel from each of the agencies were assigned to undertake the joint field investigations.

The purpose of this report is to:

1. Summarize available information pertaining to the pollution problem of the Lower Columbia River.
2. Review the status of additional remedial measures taken since the 1958-59 Conference.
3. Recommend a course of action designed to correct the pollution problem.

Acknowledgment is made to the Oregon State Sanitary Authority and the Washington State Pollution Control

Commission for their contribution of background and factual information from which the conclusions and recommendations of this report have been drawn.

Special recognition is given to Mr. Robert McHugh of the Oregon State Sanitary Authority for his contributions to a greater understanding of the Lower Columbia River slime problem.

While liberal use of information supplied by others has been made, this report is the sole responsibility of the U. S. Public Health Service.

AREA

The section of the Lower Columbia River from Bonneville Dam to Cathlamet, Washington, with which this report is concerned, is shown in Figure I. This 104-mile reach is more highly developed than any other comparable length of the main river.

Along this section of the river live more than a million people, of whom over three-fourths live in the metropolitan area of Portland, Oregon-Vancouver, Washington. Longview, Washington, is also one of the principal cities in the area. There is a total of ten sewered communities and several small miscellaneous sewerage systems.

Several types of manufacturing contribute toward a balanced economy for the region. Power produced from the river has brought many electrometallurgical plants to the area. There are numerous food-processing plants. Diversified manufacturing and the service industries characteristic of a regional center are the principal supports of the Portland area. Wood products plants, which include the pulp and paper mills, constitute the major manufacturing industry for the entire area.

Income from fishing is important in the area's economy. The Columbia is justly famed for its salmon and steelhead trout. In fact, these two species of fish are so popular that most commercial and sport fishermen look with disdain on all other kinds of fish, even those which are highly prized in other sections of the country.

Excellent water transportation contributes to the prosperity of the area. Although Portland is over 100 miles from the ocean, the Columbia makes it one of the important regional transportation and distribution centers of the Pacific Coast.

This section of the Columbia is subject to tidal action as far upstream as Bonneville Dam. The tidal range at Portland is small, not exceeding one foot. The flow in the Columbia River at Bonneville Dam usually varies from less than 100,000 cfs to over 400,000 cfs during the year. Normally there is a sharp increase in flow in May with maximum flow conditions occurring in June and July and a sharp decrease in flow in August. The remainder of the year the flow is usually nearly constant at about 100,000 cfs.

BACKGROUND

For more than 25 years the quality of the waters of the Lower Columbia River has been adversely affected by periodically abundant slime growths which flourish on nutrient materials contained in wastes discharged along the 80-mile stretch of the river between Camas and Cathlamet. The slime, called 'pollution' by commercial fishermen, is a biological mass combined with varying amounts of fiber, debris, and sand. Sphaerotilus, a filamentous bacterium which usually predominates in the mass, serves as a matrix for the attachment of microscopic plants and animals and a mechanical adherent for the suspended debris. The severity of the problem varies with temperature, streamflow, and available wood fibers and nutrients.

The slime is detrimental to, and interferes with, legitimate water uses. The commercial fishermen's nets become coated with the slime, which reduces fishing efficiency. Commercial fishermen frequently must cease fishing or be highly selective in placing their nets to prevent having them swamped with slime. Fishermen report that fibers in the slime become entangled in the knots of their nets, making slime removal an extremely difficult and time-consuming operation.

Sport fishing is a very popular recreational activity on the Lower Columbia River. Slime interferes with this water use by fouling fishing gear and aggravating sports fishermen.

Water-contact recreation, such as skiing and swimming, has been adversely affected by waste discharges. Bacterial counts, mainly from domestic sewage discharges, have been above the maximum recommended for this type of activity. The large volumes of colored and turbid wastes discharged to the river also adversely affect water-contact types of recreation. The aesthetic value of the stream is further deteriorated by biological growths which develop from the nutrients in waste discharges.

Initial attempts to control the slime problem resulted in the activation of state-agency programs with municipalities and industry. Municipal programs were directed toward the installation of waste treatment facilities. Industrial control programs were directed toward reduction of waste losses through in-plant controls and by the installation of storage lagoon facilities at one pulp mill.

Because of the magnitude of the pulp and paper industry problem, the need for intensified survey and research on all phases of waste abatement and treatment was recognized. Initially, in the late 1940's, efforts were directed to the construction of diffuser-type outfalls to achieve greater dispersion and dilution in order to reduce nutrient concentrations to a level that would not support slime growth.

These outfalls had some reducing effect on localized slime growth, but the larger problem persisted. Based on laboratory research, which indicated slime-abatement possibilities by intermittent discharge of major nutrient-bearing wastes, Crown Zellerbach installed facilities to accomplish this method of control. Unfortunately, the slime problem continues to exist and is as severe as it was 25 years ago, if not worse.

REVIEW OF PAST STUDIES

Poor water quality in the Lower Columbia has prompted numerous studies, by both governmental agencies and industry to define, evaluate, and propose measures to alleviate this problem. The following is a partial list of these studies and some of the pertinent observations that have been made.

In 1943, Lincoln and Foster (3) completed a seemingly exhaustive study of the slime problem. They concluded: "Waste sulfite liquor, and specifically the carbohydrates contained in the waste liquor, are the cause of the growth of Sphaerotilus in the Columbia River." Among other items, they also concluded that Sphaerotilus required a fixed surface on which to develop, that free-floating slime was that which had broken loose from such surfaces, and that "Sphaerotilus does not grow well in places where the concentration of waste sulfite liquor is below 50 ppm" (based on 10 per cent solids liquor, which is equivalent to 5 ppm based on 100 per cent solids liquor).

In 1951, the Washington State Pollution Control Commission conducted a study of the Lower Columbia River (4) and observed the growth of slime below all of the pulp and paper mills usually along the shore or on log rafts and noted suspended slimes occurred downstream from the observed localized areas of growth. The most profuse growth of Sphaerotilus was found near the Washington shore just downstream from the pulp mill in Vancouver.

Investigations made by the Oregon State Sanitary Authority, the Washington State Pollution Control Commission, and the U. S. Public Health Service in 1955, 1956, and 1957 (5) led to the conclusion that the pulp and paper mills are the major source of wastes which contribute to the production of slime in the river. The investigators also concluded that at times of freshet in the Willamette River, slime and associated nutrients enter the Columbia River and add to the problem.

In 1958, the report prepared by the U. S. Public Health Service (6) concluded that all evidence points to pulp and paper mill wastes as the source of nutrients for the slime growths which occur from Camas to Cathlamet in quantities that interfere with fishing operations and other legitimate water uses.

Surveillance field studies were conducted by the U. S.

Public Health Service from October 1958 to April 1960 (7). Tile boxes (8) and tow nets were used to determine the occurrence of slime. The report states, " . . . there was never any Sphaerotilus or associated slimes found at Sta. 1 (Washougal, above Camas, at R.M. 122.6).

Water quality data have been cooperatively collected since 1959 along the Lower Columbia River between Bonneville Dam and Cathlamet by the Washington State Pollution Control Commission, the Oregon State Sanitary Authority, and the Northwest Pulp and Paper Association together with the pulp mills located at Camas, Vancouver, St. Helens, and Longview; collection of the data is continuing at the present time. The purpose of this effort is to record the seasonal variation of water quality and slime growth in this section of the river. Following a statistical analysis of the data collected in 1960 by the University of Washington, Department of Civil Engineering (9), certain modifications were made in this program.

In 1960, Amberg and Cormack (10) concluded, after a three-year study, that the most important environmental factors for slime growth in the river appear to be velocity (0.4 to 2.0 fps), temperature (8° to 16° C.), and phosphate content. On the basis of laboratory results, they concluded that limited phosphate concentrations during the summer months may limit slime growth. Sphaerotilus will grow when spent sulfite solids concentrations are as low as 1 ppm (based on 100 per cent solids liquor, which is equivalent to 10 ppm based on 10 per cent solids liquor) (0.2 ppm of BOD) within the velocity range. Their laboratory studies indicated that intermittent discharge greatly reduces the slime growth on fixed surfaces.

In 1962 the Oregon State Sanitary Authority, the Washington State Pollution Control Commission, and the U. S. Public Health Service (11), in a joint evaluation concluded that the intermittent discharge from Camas appeared to control slime growths in some reaches of the main stem of the river below the mill. However, slime problems still existed below Vancouver. Increases in the volume of slime collected in tow nets were attributed to growths that had been broken loose by increased river velocity. Substantial quantities of slime were collected on one occasion at Hewlett Point and were attributed to a flushing of the Willamette River, which was at flood stage.

A report prepared by Crown Zellerbach Corporation in 1963 (12) reviewed the development of the intermittent discharge system and their river observations between Camas and Skamokawa (R.M. 36, approximately) during discharge periods. They noted optimum slime growth occurred at a temperature range of about 10° to 15° C. and that growth may occur at temperatures below 10° C., provided the growing period is sufficiently long. They reported that Sphaerotilus growth had been virtually eliminated between the Camas mill and the Interstate Bridge with intermittent discharge practices initiated by the company in late 1960. They also indicated that freshets were responsible for slime breaking loose and floating downstream. On the basis of their laboratory evaluations, Sphaerotilus will grow when the spent sulfite solids concentration is as low as 2 and 5 ppm (based on 100 per cent solids). However, the amount of slime growth with the 2 ppm concentration is less than the amount of growth observed with higher concentrations.

A status report prepared in 1963 by the Oregon State Sanitary Authority, the Washington State Pollution Control Commission, and the U. S. Public Health Service (13) noted that all of the municipalities and industries, except the pulp and paper industry, had complied with the 1959 Action Program or had plans under way for remedial work. The report also noted that slime continued to be a problem in the river.

Prior to 1964, all of these investigators believed that most of the slime grew on fixed surfaces and broke loose to create problems downstream. Slime growth was observed on log rafts, pilings, and along the shore below the pulp mills. Tile boxes (8) were developed to provide attachment surfaces to determine slime growth potentials at selected locations.

These earlier reports refer to the probability of large growing areas which would account for the large quantities of slime encountered by fishermen during critical times. In addition, these earlier studies contributed the following:

1. The carbohydrates contained in waste sulfite liquor are the principal nutrient associated with the growth of Sphaerotilus and associated biological mass in the Columbia River.

2. One investigator (12) noted that the optimum temperature range for slime growth in the river is about 10-15° C.

3. Slime will develop when the spent sulfite solids liquor concentration is as low as 1 and 2 ppm (based on 100 per cent solids), but the quantity of slime growth is not as great as at higher concentrations.

4. Low concentrations of phosphates and nitrates, in addition to carbohydrates, are essential nutrients for growth of Sphaerotilus.

5. Slime interferes with commercial and sport fishing.

6. The slime problem is more severe during low-flow periods in the spring and fall.

7. Slime with a high fiber content is more difficult to remove from fishermen's nets. A combination of fresh slime and fiber is the most difficult to remove.

8. More slime is caught on diver nets than on floater nets in the ship channel portion of the river from Kalama downstream. This indicates the slime is slightly heavier than water and is carried near the bottom in the deeper parts of the river.

9. During flood conditions the Willamette River and Multnomah Channel contribute fiber, detritus, and nutrients to the Columbia River.

WILLAMETTE RIVER

Judging from past studies, the magnitude and effect of the pollutional material in the Willamette River on the Columbia River have not been fully evaluated. Previous investigators have tended to treat the oxygen deficiency in Portland Harbor, caused by upstream waste discharges, and the slime problem in the Columbia River as separate problems. Flow variations in the two rivers coupled with the distribution of flow to the main stem of the Willamette River and Multnomah Channel suggest extensive studies would be required for a definitive answer. At various times sport fishermen have complained about tainted fish caught in the lower part of the Willamette River and Multnomah Channel. Investigations in 1965 indicate the problem is related to the discharge of industrial wastes to the river under low-flow conditions. The extent of the problem and the effects on the Columbia River have not been adequately explored.

WATER USES

The Lower Columbia River supports a wide variety of water uses and has a considerable influence on the area's economic, recreational, and aesthetic activities. Uses are generally growing at a rate exceeding the rate of population growth. The following examination provides a basis for evaluating the magnitude and importance of the various uses. Values and quantities have been used, where applicable, but these are not intended to be all-inclusive. They serve only to place the relative importance of the uses in proper perspective.

WATER SUPPLY

Municipal and industrial water supply is not presently a major use of the Lower Columbia River. One small village downstream from Puget Island and two industries withdraw water from this portion of the river. Although the village is not within the section of the river dealt with in the report, its source is subjected to bacterial contamination from upstream waste outfalls.

The Weyerhaeuser Timber Company and the Longview Fibre Company pulp and paper mills at Longview, Washington, use the Columbia River as a water source. Weyerhaeuser pumps over 100 million gallons per day (mgd) from the river; the water is treated for industrial as well as domestic use by the company. Longview Fibre Company withdraws over 50 mgd. Other known industrial supplies taken from the Columbia are quite small.

RECREATION

Because of its proximity to the Portland-Vancouver urban area and because of the influx of summer tourists, the Lower Columbia is heavily used for water-contact sports and recreation. Other than game fishing, recreational water uses include boating, swimming, skin-diving, water-skiing, and picnicking. Streamside picnicking and camping, with accompanying boating and swimming, are popular family weekend outings.

Statistics are only partially available to measure the demand for recreation, and these are more useful as an index of trends rather than as an indication of the overall dimensions of a particular recreational use. In order to quantify recreational use of water, it is necessary that the use be reasonably well organized and subject to some type of control. It must be recognized, however, that a great deal of recreation is on an informal basis, which makes evaluation difficult.

Pleasure Boating

There are numerous boat moorages on the Lower Columbia River. A major concentration of moorages extends along the Oregon bank from near the lower end of Government Island to below Interstate Bridge, which includes the Jantzen Beach Park and Marina on Hayden Island. Other main river moorages on the Oregon side are at St. Helens and Rainier. On the Washington side, there are moorages just above Camas, at Vancouver, near the mouth of the Cowlitz River at Longview, near Stella, and at Cathlamet.

The Oregon State Marine Board registers all Oregon boats by county. The three Oregon counties adjacent to the lower portion of the Columbia have licensed 15,900 boats of varying sizes. Although Washington does not register boats by county, the Oregon Marine Board has estimated that the four counties in Washington bordering the Columbia have over 6,300 boats. This figure was calculated using the national average of boats per population and is therefore conservative. It is estimated that between 22,000 and 25,000 boats use the Columbia River for at least a part of the year.

Swimming

Much of the swimming and water-skiing in the Lower Columbia is upstream from the Portland-Vancouver urban area. One of the most popular river beaches is at Rooster Rock State Park about 25 miles east of Portland. Based on car counter statistics, over 155,000 persons visited this one park in July and August of 1964, with peak days running as high as 15,000. Other water-sport areas are in the vicinity of the boat moorages which extend upstream to Government

Island, and in the vicinity of Jantzen Beach on Hayden Island, just above the Interstate Bridge.

Statistics indicate a decrease in the number of swimmers in the Portland-Vancouver area. Reeder Beach on Sauvie Island, about eight miles below the Portland sewage plant outfall, is a center of water recreation; and there are other, less organized uses of the river for swimming and water-skiing downstream to Cathlamet. Small groups are frequently observed throughout the lower section of the main river even though the river is subject to some bacterial contamination from municipal outfalls.

Hunting

The Lower Columbia provides many inlets and good cover for duck hunting, both from the land and by boat. Statistics are not available to measure the extent of this sport for the entire Lower Columbia, but counts from the game preserve on Sauvie Island indicate the popularity of the area. In 1964, over 10,000 hunter-days were recorded in this one area.

FISHERY RESOURCES

One of the outstanding uses of the Columbia River is the sport and commercial fishery. The Columbia and its tributaries contain large populations of salmon and steelhead, highly prized by sport anglers and commercial fishermen alike. The river also provides spawning areas and passage for these migratory fish, so the value of the fishery attributable to the Columbia River is considerable. Migration and spawning of the salmonid species in the upper reaches of the Columbia are so important that special fish passage facilities have been constructed to permit the fish to move past Bonneville and other upstream dams.

Sport Fishery

An intensive salmon and steelhead sport fishery occurs in and adjacent to the mouth of the Columbia River each year. The Bureau of Commercial Fisheries is currently making a study of the value of the sport fishery attributable to the Columbia River. Preliminary figures, subject to revision when tagging studies are completed, indicate that in 1964 a total of 1.3 million fisherman-days were expended to catch over 400,000 salmon and steelhead in the ocean and the river. The gross value of the sport fishery has been estimated to be about $20,000,000.

Commercial Fishery

Although the commercial fishery in the Columbia has been decreasing for several years due to restriction by the States involved, a considerable commercial value is attributable to the Columbia. Preliminary estimates by the Bureau of Commercial Fisheries indicate gross sales by fishermen in 1964 at about $6,000,000.

In 1964, 689 gill net licenses were issued to Columbia

River fishermen in Washington and Oregon. There are more ocean-troll commercial fishing licenses issued than gill net licenses. Approximately 13 million pounds of all species of salmon attributable to the Columbia River were caught in the ocean and the river. In addition, about 1-1/4 million pounds of shad, smalt, and sturgeon were caught in the Columbia for the commercial market.

HYDROELECTRIC POWER PRODUCTION

The power plant at Bonneville is the only hydroelectric power facility in this section of the Lower Columbia. It has a total rated capacity of approximately 518,400 kilowatts and produces an important portion of the total power produced in the Columbia River Basin.

Bonneville Dam is also used to control the flow in the Lower Columbia River. Although Bonneville Pool provides little storage and has relatively little effect on the average daily flow of the river, the hourly flow can be regulated, especially during times of low flow, by operation of the generators for peak power conditions.

IRRIGATION

Although irrigation is a major use of the upper reaches of the river, there is only a small amount of irrigated land along the Lower Columbia. Irrigation water is pumped from the river at 25 to 30 points between Bonneville Dam and Cathlamet and is used principally to irrigate vegetable produce. Sauvie Island is the primary section of cropland irrigated from the Lower Columbia.

NAVIGATION

Portland, Oregon, is the largest fresh water port in the world. Since 1955, shipments handled in the Columbia and Willamette Rivers have totaled 20 million tons every year but one. The Port of Portland handles a tonnage equivalent to, and in recent years greater than, that of Seattle, thus ranking it the third largest port on the West Coast. Portland is one of the largest grain ports in the country.

In addition to those at Portland, there are extensive dock facilities at Vancouver and Longview, and future development can be expected near Wauna with the completion of the new pulp and paper complex presently under construction. Intercoastal transportation is growing rapidly with the completion of harbor facilities in coastal streams.

Large numbers of log rafts are transported on the river for the lumber and pulp and paper plants in the area. The logs, while awaiting use, are stored in quiet areas along the river banks and in sloughs on either side of the river. Most of the storage areas are between Camas and Cathlamet, Washington, with only a limited amount of storage between Camas and Bonneville Dam.

PRESENT WASTE SOURCES

The locations of the waste sources involved in this report are shown in Figure II on page 38.

MUNICIPAL

All of the following municipalities have sewage treatment plants which provide primary sedimentation and effluent disinfection:

Oregon	Washington
Clatskanie	Cathlamet
Rainier	Longview
St. Helens	Kalama
Portland	Vancouver
Portland Airport	Camas
Gresham	

The effluent from all of these plants is discharged to the Columbia River. The details pertaining to wastes from these municipalities are summarized in Table II on page 39.

INDUSTRIAL

Details pertaining to all the sources of industrial wastes involved in this report are summarized in Table III on page 40.

Grain Washing

Washing of grain to remove foreign or undesired matter is employed at Continental Grain Company, Longview; North Pacific Grain Growers, Inc., Kalama; and Archer-Daniels-Midland, Vancouver. Waste matter from this operation consists of cracked or crushed grain, smut, chaff, and weeds. Until early 1964, these wastes were discharged directly to the Columbia River. Since that time, the wastes have been collected by screening (50 mesh) and utilized for animal feed or disposed of on land. Some grain does not require washing and, as a result, waste discharges fluctuate. The liquid portions of the wastes are discharged to the river through submerged outfalls.

Food Processing

Solid and liquid wastes result from processing of fruit and vegetables at California Packing Company and Washington Canners at Vancouver. Solid wastes consist of peelings, pits, seeds, and culls, while liquid wastes contain dissolved organic material. By use of sumps and screens, the solid wastes are collected and disposed of on land. The liquid wastes pass 20-mesh screens and are then discharged to the Columbia River through a submerged outfall. Sanitary sewage is discharged to the city sewer system.

Malting and Brewing

The Great Western Malting Company, Vancouver, produces malt used in the brewing industry. The primary source of process waste results from a grain-steeping operation in which steeping liquid is drained. These wastes are screened (20 mesh) before being discharged to the Columbia River. Spent grains are collected and used for animal feed.

Sanitary sewage is discharged to the city sewer system.

The Lucky Lager Brewery, Vancouver, collects spent brewing grain, hops, and surplus yeast to be used as animal feed or fertilizer. Process and clean-up wastes and spoiled beer are screened prior to discharge to the city sewer system along with the sanitary sewage.

Pulp and Paper

Details pertaining to the reported pulp and paper production for the mills discussed in this section are summarized in Table IV on page 41.

The Weyerhaeuser Timber Company, Longview, operates a 1,160 ton/day pulp mill, of which 725 tons are produced by the sulfate process, 325 tons by the sulfite process, and 110 tons by the semi-chemical pulping process. From this pulping operation, 925 tons/day of bleached pulp are produced. Paper production is 470 tons/day and the remaining pulp is sold. In 1948, this mill converted its calcium base sulfite mill into a magnesium base sulfite mill, with evaporation and burning of the concentrated cooking liquors for recovery of the magnesium oxide. The sulfate and semi-chemical pulping operations also have an integrated base recovery system. Savealls are used to recover fiber from the paper machine white water streams. Waste water from the hydraulic barker is clarified in a settling basin to remove settleable solids. Monthly effluent loss reports have been submitted to the Washington State Pollution Control Commission since 1956 and presently include solids and BOD losses. The reported 1964 losses discharged to the Columbia River were 59,000 pounds /day of VSM and 150,000 pounds/day of BOD in an average effluent flow of 101 million gallons per day (mgd). Sanitary sewage is treated at the mill's primary treatment plant, and the effluent is chlorinated. The sanitary and mill process wastes are combined and discharged through a submerged diffuser outfall into the Columbia River.

The Longview Fibre Company, Longview, produces 1,270 tons/day of pulp, of which 1,160 tons are produced by the sulfate process, 25 tons by the groundwood process, and 85 tons by the semi-chemical pulping process. From this pulping operation, 220 tons/day of bleached pulp are produced. In addition, 1,260 tons/day of paper are produced. This mill incorporates evaporation and burning of the concentrated cooking liquors for recovery of the base chemicals. Also, a portion of the evaporator condensate is processed and the chemicals are reused. Savealls are utilized to reclaim fibers from the paper machine white water streams. Effluents from the groundwood operation are almost entirely reused in other mill processes. Monthly effluent loss reports have been submitted to the Washington State Pollution Control Commission since 1956, and present reports include solids and BOD losses. Reported 1964 losses to the Columbia River were 47,500 pounds/day of VSM and 80,000 pounds/day of BOD in an average effluent flow of 51 mgd. The mill operates its own primary sanitary sewage treatment plant and chlorinates the effluent. The sanitary sewage effluent and mill effluent are combined and discharged through a single submerged diffuser outfall into the Columbia River.

The Boise-Cascade Paper Corporation (formerly Crown Zellerbach Corporation), St. Helens, Oregon, produces 396 tons/day of sulfate pulp. From this pulping operation, 291 tons/day of bleached pulp are produced. In addition, 361 tons/day of paper are produced. The mill effluent is discharged into Multnomah Channel about one-quarter of a mile upstream from its confluence with the Columbia River. This discharge point is approximately midway between the entrance of Scappoose Bay to Multnomah Channel and the confluence of the channel with the Columbia River. Evaporation and burning of concentrated waste liquors for recovery of base material are practiced. Savealls are utilized to recover usable fibers from the paper machine white water streams. Mill waste loading data have been submitted to the Oregon State Sanitary Authority since September 1959 except during the times the Columbia River floods and submerges the sampling weir. Reported 1964 average losses to Multnomah Channel were 40,100 pounds/day total suspended matter (TSM) and

23,250 pounds/day of BOD in an average volume of mill effluent of 26.3 mgd. Septic tanks with underground absorption fields are utilized for the disposal of sanitary sewage.

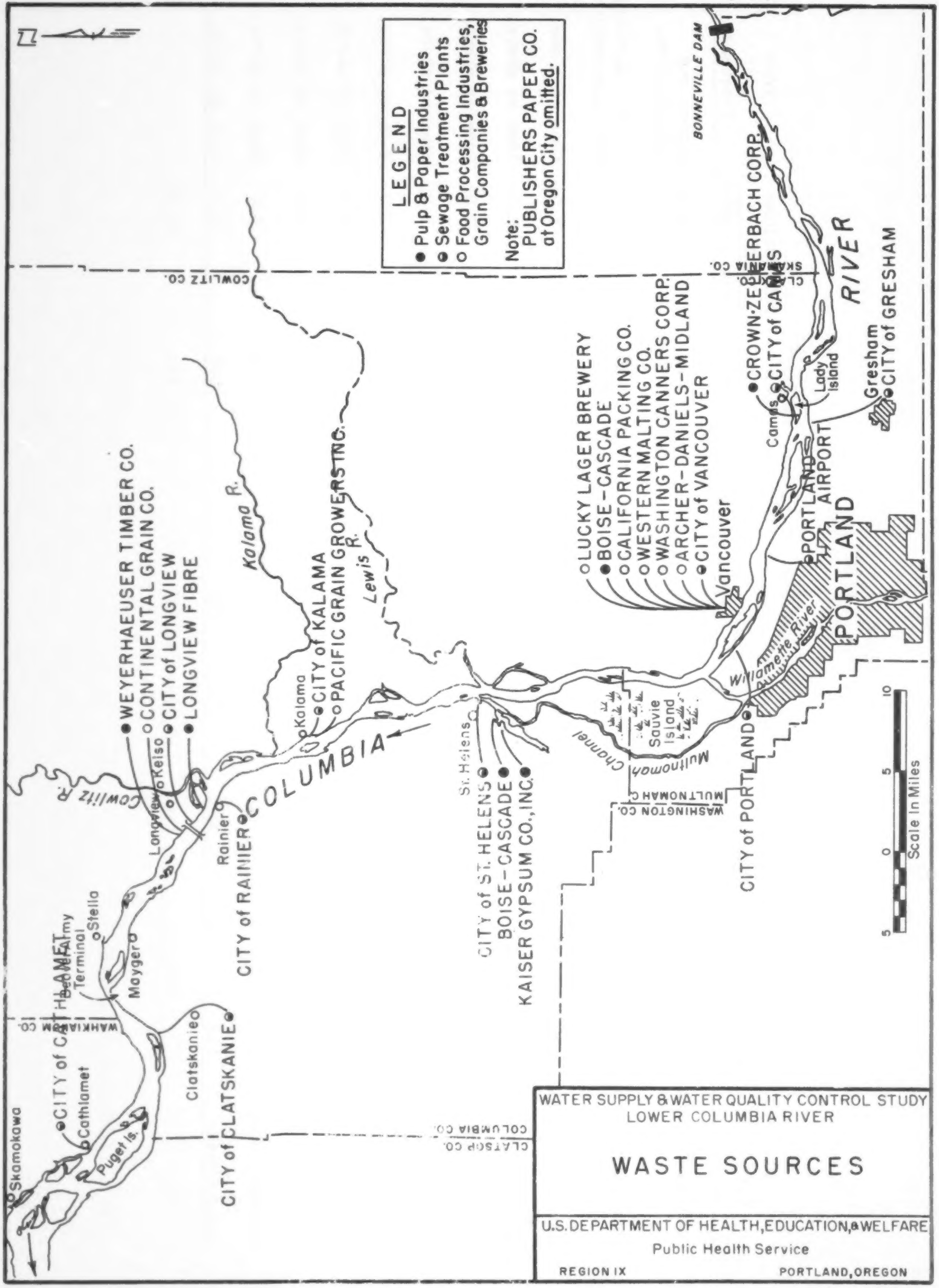
The Kaiser Gypsum Company, St. Helens, Oregon, operates a 165 ton/day groundwood pulp mill, which produces 438 thousand square feet per day of one-half-inch-stock softboard. The three waste discharge points are all located near the mouth of McNulty Bay, about three-quarters of a mile upstream from the Scappoose Bay entrance to Multnomah Channel. Weekly data on BOD and suspended solids loadings have been reported to the State Sanitary Authority by the Kaiser Gypsum Company since 1960. In 1964 the reported average losses were 7,025 pounds/day of BOD and 8,575 pounds /day TSM. The mill effluent averages 1.4 mgd. More efficient new equipment is being installed to replace older equipment, and this should reduce waste losses. The company has initiated a continuing waste reduction program through the recovery of all usable fiber by water reuse. Septic tanks with underground absorption fields are utilized for the disposal of sanitary sewage.

The Publishers Paper Company, Oregon City, Oregon, produces 452 tons/day of pulp, of which 295 tons are produced by the groundwood process and 157 tons by the sulfite process. There is no recovery of base material from the concentrated waste liquor. During the critical flow season in the Willamette River, usually from June to November, the company barges concentrated spent sulfite liquor for discharge into the Columbia River below the junction of the Willamette River. This practice was initiated in 1953. The 1964 average BOD load discharged to the Columbia River between June 29 and November 1 was 60,000 pounds/day in an average volume of 373,600 gallons/day.

The Boise-Cascade Paper Corporation (formerly the Columbia River Paper Mill), Vancouver, operates a 165 ton/day sulfite mill. Bleached pulp production is 159 tons/day. About 171 tons of fine writing and specialty paper are produced per day. There is no recovery of base chemicals from concentrated cooking liquors at this mill. Savealls are used to recover usable fibers from paper machine white waters. Effluent loss reports have been submitted monthly to the Washington State Pollution Control Commission since 1956 and include solids losses. Reported VSM losses in 1964 averaged 16,200 pounds/day. The 1964 BOD losses were estimated to be 133,000 pounds/day. An average of 15.3 mgd of mill effluent is discharged into the Columbia River through a deep water diffuser outfall installed in 1964. Sanitary sewage is discharged to the City of Vancouver collection system for treatment.

The Crown Zellerbach Corporation, Camas, operates a 1,190 ton/day pulp mill, of which 745 tons are produced by the sulfate process, 420 tons by the sulfite process, and 25 tons by the groundwood pulping process. From this pulping operation, 940 tons/day of bleached pulp are produced. In addition, 1,040 tons/day of paper and tissue products are produced. The conventional evaporation and burning recovery system is utilized for the sulfate process. Savealls are used to recover usable fibers from the paper machine white waters. Groundwood mill effluents are essentially reused in other mill operations. Monthly effluent loss reports have been submitted to the Washington State Pollution Control Commission since 1956 and include solids losses from the various operations. Reported 1964 VSM losses to the Columbia River averaged 81,000 pounds/day. BOD losses were estimated to be 325,000 pounds/day, of which 280,000 pounds/day were stored in a 46-acre holding lagoon on Lady Island. The pond was normally discharged to the Columbia River through a submerged outfall every seventh day and represented a BOD discharge for that day of 1,960,000 pounds. The remaining 45,000 pounds of BOD were discharged daily to the river through a submerged outfall. Sanitary sewage from the mill is treated at the City of Camas sewage treatment plant.

The mill lagoon is capable of storing 85 per cent of the sulfite liquors for a period of 60 days. In 1965, the mill stored this amount of liquor during the usually severe slime growth season of April and May.


LEGEND
● Pulp & Paper Industries
◎ Sewage Treatment Plants
○ Food Processing Industries, Grain Companies & Breweries
Note: PUBLISHERS PAPER CO. at Oregon City omitted.
BONNEVILLE DAM
CROWN-ZELLERBACH CORP.
CITY of CAMAS
Camas
Lady Island
RIVER
Gresham
CITY of GRESHAM
PORTLAND AIRPORT
PORTLAND
LUCKY LAGER BREWERY
BOISE-CASCADE
CALIFORNIA PACKING CO.
WESTERN MALTING CO.
WASHINGTON CANNERS CORP.
ARCHER-DANIELS-MIDLAND
CITY of VANCOUVER
Vancouver
Willamette River
CITY of PORTLAND
Sauvie Island
Multnomah Channel
SKAMANIA CO.
CLARK CO.
COWLITZ CO.
MULTNOMAH CO.
WASHINGTON CO.
COLUMBIA CO.
CLATSOP CO.
WAHKIAKUM CO.
Lewis R.
Kalama R.
Kalama
CITY of KALAMA
PACIFIC GRAIN GROWERS INC.
St. Helens
CITY of ST. HELENS
BOISE-CASCADE
KAISER GYPSUM CO., INC.
COLUMBIA
Rainier
CITY of RAINIER
Cowlitz R.
Longview
Kelso
WEYERHAEUSER TIMBER CO.
CONTINENTAL GRAIN CO.
CITY of LONGVIEW
LONGVIEW FIBRE
Stella
Beaver Army Terminal
Mayger
Clatskanie
CITY of CLATSKANIE
CITY of CATHLAMET
Cathlamet
Skamokawa
Puget Is.
Scale In Miles
5
0
5
10

WATER SUPPLY & WATER QUALITY CONTROL STUDY
LOWER COLUMBIA RIVER

WASTE SOURCES

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Public Health Service
REGION IX PORTLAND, OREGON

FIGURE II

TABLE II
MUNICIPAL WASTES

City	River Mile	Estimated Connected Population		Est. Lbs. BOD/day Treatment Plant Effluent		Est. Lbs. VSM/day[a/] Treatment Plant Effluent		Est. Volume MGD		Type of Treatment
		1959	1964	1959	1964	1959	1964	1959	1964	
Cathlamet, Wash.	40	400	500	70	85		75		0.06	Lagoon and chlorination.
Clatskanie, Oreg.	49	800	800	90	90		80		0.3	Primary settling and chlorination.
Longview, Wash.	66	20,000	22,700	2,250	2,500		2,000		2.5	Same as above.
Rainier, Oreg.	67	1,200	1,200	135	135		120		0.2	Same as above.
Kalama, Wash.	74	425	450	45	50		40		0.05	Same as above.
St. Helens, Oreg.	86	4,500	4,960	500	550		490		1.2	Same as above.
Portland, Oreg.	105.5	280,000	370,000	45,000	42,750		36,500		62.0	Same as above.
Vancouver, Wash.	106	30,000	31,800	3,700	3,500		2,800		3.5	Same as above.
Portland Airport	110	3,000	3,000	330	330		30		0.4	Same as above.
Gresham, Oreg.	117.7	3,000	4,500	330	495		50		2.0	Same as above.
Camas, Wash.	118	4,400	4,550	475	500		400		0.7	Same as above.
TOTAL		347,725	444,460	52,925	50,985		42,585		72.91	

[a/] Volatile Suspended Matter

TABLE III
INDUSTRIAL WASTES

	Est. Lbs. BOD Per Day 1959	Est. Lbs. BOD Per Day 1964	Est. Population Equivalent a/ for BOD Per Day 1959	Est. Population Equivalent a/ for BOD Per Day 1964	Est. Lbs. VSM b/ Per Day 1959	Est. Lbs. VSM b/ Per Day 1964	Est. Volume MGD 1959	Est. Volume MGD 1964	Total Solids Per Day 1959	Total Solids Per Day 1964
Grain Storage										
Continental Grain Co.	1,500	400	8,800	2,400		300		0.750		
N. Pacific Grain Growers, Inc.	1,500	400	8,800	2,400		300		0.500		
Archer-Daniels-Midland	1,500	400	8,800	2,400		300		0.475		
Food Processing										
California Packing Co.	13,400	15,000	78,800	88,200		1,500		1.3		
Washington Canners	3,640	14,000	21,000	82,000		1,400		0.29		
Malting and Brewing										
Great Western Malting Co.	2,600	2,500	15,300	14,700		Negligible		3.6		
Lucky Lager Brewery	3,000	2,500	17,600	14,700		Negligible		1.0		
Totals	27,140	35,200	159,100	206,800		3,800		7.915		
Pulp and Paper										
Weyerhaeuser Timber Co.	130,000	150,000	765,000	882,000	36,800	59,000	75	101	640,000	921,000
Longview Fibre Co.	46,000	80,000	271,000	471,000	35,700	47,500	36	51	156,000	274,000
Boise-Cascade, St. Helens	c/	23,250	c/	137,000	50,100 d/	40,100 d/	26	26.3	c/	c/
Kaiser Gypsum Co.	c/	7,025	c/	41,300	c/	8,575 d/	c/	1.4	c/	c/
Publishers Paper Co. e/	c/	60,000	c/	353,000	---	---	0.33	0.37	220,000	392,000
Boise-Cascade, Vancouver	105,000	133,000	618,000	782,000	12,800	16,200	13.2	15.3	260,000	326,000
Crown Zellerbach	260,000	325,000	1,530,000	1,910,000	62,000	81,000	126	148	1,275,000	1,750,000
Totals	541,000	778,275	3,184,000	4,576,300	197,400	252,375	276.53	343.37	2,551,000	3,663,000

a/ Population equivalent based on 0.17 lb. BOD/capita.
b/ Volatile suspended matter.
c/ No data available.
d/ Total suspended matter.
e/ Reported figures pertain only to wastes barged to the Columbia River from 6/22/59 to 10/31/59 and from 6/29/64 to 11/1/64.

TABLE IV
REPORTED PULP AND PAPER PRODUCTION
LOWER COLUMBIA RIVER AND MULTNOMAH CHANNEL

Plant	Pulp - Tons/Day												Paper - Tons/Day	
	Sulfite		Sulfate		Semi-Chemical		Groundwood		Total Pulp Production		Total Bleached Pulp Production		Paper Production	
	1959	1964	1959	1964	1959	1964	1959	1964	1959	1964	1959	1964	1959	1964
Weyerhaeuser Timber Co., Longview, Wn.	260	325	490	725	176	110			926	1,160	690	925	430	470
Longview Fibre Co. Longview, Wn.			845	1,160	59	85	21	25	925	1,270	123	220	920	1,260
Boise-Cascade Paper Corporation St. Helens, Ore.			358	396					358	396	258	291	326	361
Kaiser Gypsum Co. St. Helens, Ore.							145 a/	165	145	165	None	None	None	None
Publishers Paper Co. Oregon City, Ore.	119	157					195 a/	295	314	452	b/	b/	b/	b/
Boise-Cascade Paper Corporation Vancouver, Wn.	132	165							132	165	125	159	134	171
Crown Zellerbach Corp. Camas, Wn.	370	420	580	745			26	25	976	1,190	670	940	865	1,040
Totals	881	1,067	2,273	3,026	235	195	387	510	3,776	4,798	1,866	2,535	2,675	3,302

a/ Lockwood Directory of the Pulp and Paper Industry.

b/ Production not directly applicable to Columbia River.

PROGRESS IN POLLUTION ABATEMENT SINCE 1958-59 CONFERENCE

STATE ACTION

Following the 1959 Conference, the States of Oregon and Washington, with the support of the Technical Coordinating Committee, initiated a cooperative pollution-abatement program to accomplish the objectives of the Conference. The Oregon State Sanitary Authority had to institute legal proceedings before the City of Portland agreed to install chlorination facilities at the city's sewage treatment plant. Late in 1959, St. Helens, Oregon, completed a new sewage treatment plant with the assistance of a Public Law 660 grant approved by the Oregon State Sanitary Authority. The construction of intercepting sewers in Vancouver and of a new treatment plant in Cathlamet required considerable effort on the part of the Washington State Pollution Control Commission, in addition to Public Law 660 financial assistance. The Washington State Pollution Control Commission also worked with the three grain companies in Longview, Kalama, and Vancouver in the development and construction of screening equipment to treat grain-washing wastes.

The Technical Coordinating Committee agreed to delay upgrading requirements for the pulp and paper industry until evaluations could be made of the intermittent discharge method of disposal at Camas and the effect at all the mills of in-plant process changes on waste discharged to the river. Crown Zellerbach, Weyerhaeuser, and Longview Fibre have valid waste discharge permits which expire December 4, 1967; August 15, 1968; and February 14, 1969, respectively. These permits, which are subject to upgrading, do not require primary sedimentation or biological treatment of the wastes at the present time. The permit for the Boise-Cascade mill at Vancouver has expired and has not been renewed.

Although no deadline has been established, the Oregon State Sanitary Authority has requested the Boise-Cascade Paper Corporation to reduce its fiber and BOD losses at its St. Helens mill and to study methods of solids reduction by primary treatment. The Kaiser Gypsum Company likewise has been requested to reduce its fiber and BOD losses sufficiently to abate the pollution of Scappoose Bay. The latter company has reportedly already reduced its BOD loadings by more than 56 per cent and has plans under way for effecting further reductions.

By 1964 it became apparent that the slime problem resulting from both the intermittent waste discharge practice and the losses of wood fibers to the river was such that the water quality limits adopted by the conferees in 1959 were being exceeded. On the basis of this observation, the Public Health Service wrote both State regulatory agencies on June 1, 1964, stressing the need to upgrade the waste disposal requirements of the pulp and paper mills and suggesting that an enforcement hearing be called to accomplish needed improvements. As a result, representatives of the Washington State Pollution Control Commission visited each of the mills in the State of Washington to discuss the upgrading of treatment requirements.

MUNICIPAL

All of the cities and towns provide at least primary treatment with effluent disinfection, with improvements having been made at St. Helens, Portland, and Vancouver since 1959. New facilities at Cathlamet, Washington were completed and placed in operation in 1965. Consequently, the municipalities have complied with minimum treatment requirements adopted by the Conference. However, this progress does not preclude the need for additional improvements to collection systems and treatment plants to prevent bypassing of raw sewage to the river either from infiltration during wet weather or from overloading the facilities due to growth of the city. Continual maintenance is required to cope with sewer infiltration problems.

A bacteriological survey of the Columbia River in the Portland-Vancouver area was completed in September 1964. The results of this survey (14), when compared with similar surveys in 1960, 1962, and 1963, show a great reduction in coliform bacteria. The bacterial quality of the Columbia

River now closely approaches the standards adopted by the Conference.

In the Portland area, raw sewage or untreated industrial wastes are still being discharged into the Willamette River from some 27 city-owned and 25 private sewers (15). In 1963 these discharges had a population equivalent of 112,000. During 1964 a number of these sewers were intercepted, and the population equivalent of the untreated discharge is now 28,000. A deadline of December 1967 has been established by the Oregon State Sanitary Authority for the installation of sewage and waste-treatment facilities by all cities and industries discharging wastes to the Willamette River to provide secondary treatment which will remove not less than 85 per cent of the BOD and TSM. Although Portland has spent some 20 million dollars since 1947 for the construction of interceptor sewers and treatment works, another 11 to 19 million dollars is needed to complete the job of abating its share of the pollution in the Willamette.

Houseboats also discharge raw sewage to the river. The regulatory agencies have undertaken a study to determine the extent of the problem and to find a satisfactory solution. The State of Oregon enacted a new legal statute during the 1965 Legislature to regulate the discharge of these wastes.

INDUSTRIAL

The Technical Coordinating Committee has determined that all of the industries discharging wastes directly to the Lower Columbia River have complied with the minimum treatment requirements adopted by the Conference, except the pulp and paper industry. The three grain elevators now have screening facilities to prevent the discharge of waste grain to the river. The two food-processing plants separate their solid wastes and screen their process waters in order to minimize the discharge of objectionable waste solids to the river. Both the malting plant and the brewery either have screening facilities to prevent the entrance of solid wastes into the river or discharge their wastes to the city sewer system.

Following the 1959 Conference, Crown Zellerbach Corporation at Camas proposed the construction of a waste-holding pond for intermittent discharge of its concentrated wastes. The proposal was based on company laboratory research which indicated Sphaerotilus would not grow and develop to any extent on a fixed surface exposed to waste liquors only one day each week. The company placed its 46-acre holding pond in operation late in 1960. An initial evaluation of this method had shown a reduction in the slime problem between Camas and Vancouver.

Based on this initial evaluation, the Columbia River Paper Mill, Vancouver, on October 10, 1961, proposed construction of waste-holding facilities. In 1962 the Technical

Coordinating Committee conducted an evaluation study, and the Washington State Pollution Control Commission made an in-plant survey before approval was given to this proposal. Before plans could be completed and approved, the mill was sold to Boise-Cascade, which on September 10, 1963, proposed evaporation and burning of its wastes and other changes as a more effective answer to its waste problem. The waste outfall was extended 580 feet into the river during April and May 1964 as a preliminary step to the installation of equipment for the reduction of slime growth in the river.

The delay in effecting progress in the elimination of the slime problem is the result of the pulp and paper industry's attempt to find a substitute for waste treatment and their desire to more fully evaluate the effectiveness of substitute measures to control slime growths in the river. Consequently, progress in correcting pollution caused by these mills has been minimal since the Conference.

COMPARISON OF 1959 AND 1964 WASTE LOADINGS

Since 1959, the average daily BOD load discharged to the Columbia River from all sources of wastes has increased over 165,000* pounds/day -- an increase of 25 per cent. The loading from the pulp and paper industry has increased 27 per cent and represents 96 per cent of the total increase in BOD loadings during the five-year period. While the other industries shows a 30 per cent increase in BOD loadings, this amount represents less than five per cent of the total increase. The BOD load imposed by the municipalities has decreased slightly during this period.

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*The BOD increase for the three Oregon mills has been calculated in proportion to the increase in pulp production and represents about 10 per cent of the total.

Between 1959 and 1964, pulp production for all of the mills has increased 27 per cent (1,022 tons/day), while paper production has increased 23 per cent (627 tons/day). The greatest increase in daily BOD and VSM loadings to the river has been in the Longview area. The pulp production capacity in this area has increased 579 tons/day, or 31 per cent. Paper production has also increased 380 tons, or 28 per cent. The corresponding increases in BOD and VSM loadings to the river are 31 per cent and 47 per cent, respectively. In the Vancouver area the increase in both BOD and VSM loadings to the river from the pulp and paper mill wastes has been 27 per cent. In the Camas area the average daily BOD produced has increased 25 per cent, while the VSM discharged to the river has increased about 31 per cent. While the intermittent discharge practice at Camas has resulted in decreased BOD loading to the river six days a week, when compared with 1959, the large 1,960,000 pound 'slug' of BOD discharged from the holding pond on the seventh day actually represents a 25 per cent increase in loading when considered on the weekly basis.

EFFECTS OF WASTE ON WATER QUALITY AND USES

RIVER SURVEY, 1964

Early in 1964, Mr. Robert McHugh of the Oregon State Sanitary Authority had completed translation of German literature relating to similar slime problems (16). The German observers report slime will develop and grow on suspended debris in large, deep rivers. On the basis of this finding and the abundance of slime reported by fishermen during snagging operations in February and March, a limited sampling program was undertaken by representatives of the Oregon State Sanitary Authority, Washington State Pollution Control Commission, and the U. S. Public Health Service during April and May. Sampling equipment, similar to that reported in German literature, was used to collect samples from different depths and locations. Details pertaining to the equipment and sampling procedures are included in Appendix A, and commercial fishermen's drifts are shown in Figure III. The results of the sample analyses are given in Appendix B. These samples show the existence of fiber in both the Columbia River and Multnomah Channel and the growth of Sphaerotilus and other biota.

BIOLOGICAL OBSERVATIONS, 1964

In addition to the sampling program, Mr. McHugh made biological observations of the slime problem during the fishermen's snagging and fishing operations. The biological evaluation of the slime problem in the river is as follows:

Nature of Slime Deposits

In the lower river, from Clatskanie to the bay, slime removed from gill nets consists largely of wood fibers, stuck together by a dark, amorphous material resembling decomposed *Sphaerotilus*. Up to 15 per cent of the volume was composed of algae, mostly diatoms, with some filamentous algae usually found growing attached to log rafts, pilings, and stones. The algae give the slime a dark-green color, and, as some diatoms themselves secrete a mucilaginous covering, may contribute to the sticking together of the fibers. No fresh, recognizable filaments of *Sphaerotilus* usually occur, although there have been reports of masses of light-yellowish biological masses in this area, which may well have been growing slime bacteria. At least two of the samples collected from fishermen's nets at Clatskanie during the fall 1964 season contained small amounts of new, growing *Sphaerotilus*. The origin of this material is not known.

From approximately Rainier to Vancouver, the percentage of wood fibers in the biological masses diminishes, and more than half of the fibrous content may consist of fragments of grass, leaves, and other organic trash on which filaments of growing *Sphaerotilus* may grow. There are also much dark, decomposed slime and some algae present. Many of the leaf and grass fragments were so heavily overgrown by mycelia of water molds (Phycomycetes) that the mycelia comprised a definite part of the volume of organic matter. Water molds attack and disintegrate specific organic substrates; some attack live plants, some dead plants; some attack algae; others only the cast skins of insects, etc. During the sampling in the Stella area (May 15-16, 1964), an experimental gill net was drifted near the bottom and became heavily coated with slime which included much plant debris, some wood fiber, and Sphaerotilus. On drying, almost all of the slime crumbled off the net in the form of a fine powder, possibly because the organic substrates had been nearly disintegrated by the action of water molds and bacteria. Upriver from Vancouver, gill net fishermen have generally not complained of slime problems, although the 'slug' of lagooned waste periodically released from the Camas lagoon passes through these drifts. It is the general practice of the fishermen not to fish during the time this discharge is passing through the area.

During the period April 1-8, 1964, a break occurred in a pipeline at Camas, and during this nine-day period an estimated 20 per cent of the sulfite liquor escaped into the river as a continuous discharge. The last day on which leakage occurred was the 8th. Following repair of the leak, all wastes were ponded until the 12th, when the lagoon was discharged. On the 12th fishermen in the Brickyard Drift, east of the Columbia River Interstate Bridge, complained for the first time of fouled nets, and sent in samples. The samples consisted almost entirely of new, growing Sphaerotilus in large masses, similar to the appearance of this organism when growing as a coating on pilings. There was little fiber, trash, or other substrate present. This biological mass differed from that found farther down the river in that it could be easily removed from the nets. The channel at this point follows the Washington shore, and the growth was concentrated there. When the fouled nets were drifted closer to the Oregon shore, where the water was cleaner, most of the material washed away rapidly.

There are at least three kinds of slime or biological masses affecting gill nets:

a. Slime composed mostly of wood fibers stuck together by decomposed Sphaerotilus and perhaps mucilaginous algae, which is very difficult to get off nets when wet and nearly impossible to remove when dry as it hardens to a substance resembling putty or plastic wood.

b. Biological masses with a heavy content of plant trash and leaf and grass fragments which adhere to nets when wet, but crumble away when dry.

c. Masses composed almost entirely of

Sphaerotilus which are easily removed. This type of growth probably develops on fixed surfaces and breaks loose.

Distribution of Suspended Slimes in the Columbia River

a. Bottom Deposits and Attached Growths: During snag-removing operations preceding the gill net seasons, skin divers look over much of the bottom of the river from Bonneville to the mouth. At other times they also spend time on the river looking for sunken boats, motors, tools, etc. Every one of the skin divers interviewed has stated that he has not observed deposits of slime, fiber, or ooze anywhere on the Columbia below Bonneville. The bottom consists generally of clean sand, varied here and there by rock ledges and piles of rock or gravel spilled from barges.

The only attached slimes found in the Columbia are those growing on pilings up to a few hundred feet below outfalls from various industries. These attached growths are insignificant in amount and are composed almost entirely of masses of Sphaerotilus. This is not the case with most of the suspended slimes.

b. Non-Attached Growths: Essentially all drifting slimes seem to originate in the growth of Sphaerotilus-type, fillamentous, slime-secreting bacteria on suspended organic substrates. These attachments are of plant origin and include wood fibers, sawdust, softwood tree needles, fragments of leaves and grass, and bits of paper. Attachment to other suspended detritus, such as diatoms, sand grains, shed insect and crustacean skins, and the like, occurs infrequently, if at all. The size of the substrate materials ranges from a few microns in the case of small wood fibers to several inches across in the case of dead leaves, but most are less than an inch in length. In relatively quiet water, as in impoundments, each substrate particle becomes surrounded with a ball-like growth of bacteria. In turbulent waters, such as the Columbia River, the flocs more often assume an irregular, extended, thread-like form. Because the flocs are sticky, they tend to adhere together in twisted, twine-like masses up to several inches in length, and it is these stringy flocs which so easily lodge against gillnets and lines. Investigators have found that these flocs begin to form rapidly below outfalls containing suitable nutrient concentrations. Flocs reach maximum size about 0.6 mile below the outfall. At approximately six to twenty miles below the outfall (at flows of two to three miles per hour), disintegration begins. Starting at the center, flocs become progressively darker in color and crumbly in consistency. The end product of the decomposition process is a dark-brown amorphous mass in which filaments can no longer be distinguished.

c. Vertical Distribution of Drifting Slimes: European work on distribution of drifting slimes below sulfite pulp mills has shown that there is much more of it in the bottom waters than near the surface (16). This appears to be generally true in the Columbia River. Gill net fishermen here are convinced that the slime concentrates in the ship channel. For example, if the channel is close to the north shore, there may be no noticeable slime in the southern half of the river. From the center toward the north shore, nets collect progressively more slime. Every effort is made to keep nets out of the channel where the slime concentration is greatest. These nets drag the bottom and extend upward for about five feet above the bottom. Suction-pump sampling at different depths shows in general the same thing, although no systematic cross-section sampling of the river has been done. There are, however, at least three exceptions to slime concentrations in the channel:

1. Where the channel crosses from one side of the river to the other. In this case, the slime is washed out of the channel, and the entire river may be dirty for some distance below.

2. Below sharp bends in the river. Turbulent conditions in such situations may sweep slime out of the channel.

3. Strong tidal action in the lower river.

West of Puget Island the slime is found across the entire river. Strong tidal currents are responsible for this.

There is much top-to-bottom turbulence during tidal changes as well. When the tide is running in or out, large 'boils' are constantly breaking the surface, and masses of fiber and debris rise in the boils. In the slack water between tides, much of this material sinks out of sight. In the Beaver Army Terminal area it is calculated that tides will exert the greatest effect on slime when the river discharge is below 220,000 cfs*. The combination of low river flow and flooding portions of maximum tides will result in virtual stoppage and reversal of the river current. During these periods the slime will settle to the lower-velocity layers and, on the ebb tide, will move downstream but at a slower rate than if it had remained in the higher-velocity layers. The net effect would be a greater concentration of slime during the critical tidal and low-flow periods. Most complaints from fishermen during 1964 concerning slime came from the lower river.

FISHERMEN'S REPORTS

Late in 1960, a reporting program was initiated in cooperation with the commercial fishermen to gather more specific information regarding the frequency of occurrence and severity of the slime problem. Forms were provided for fishermen who work the various drifts, on which they were asked to report river conditions and the relative amounts of slime encountered during their fishing operations. Some were more diligent than others and provided a continuous record of conditions during the fishing season, while others reported only when conditions were bad. Such data reflect the river conditions only during the six yearly commercial fishing seasons (about 116 days a year). Except for the first season, there are weekly closures of up to four days.

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*See explanation of Evaluation Procedures in Appendix C.

The fishing schedule is such that it is possible for the intermittent waste discharge from Camas to pass through the upper river drifts while the season is closed. Reportedly, some of the fishermen are selective and either do not fish or avoid sections of their drifts where slime is known to exist. Because of these factors, it is impossible to note the effects each of the intermittent discharges has upon all of the drifts.

The intermittent waste discharge from Camas causes a change in water quality and in river conditions that can be traced with water quality tests (12), and these tests have confirmed calculated river flow data. Each fisherman's report was reviewed initially to determine if the reporting period coincided with the passage of an intermittent discharge through the drift. The following pertinent observations can be drawn from the tabulation of the fishermen's reports with river conditions:

1. Reports were received of either live or dead, or both live and dead slime at drifts on the Lower Columbia River for a discharge range of 81,660 cfs to 437,130 cfs and a temperature range of 5.6° C. to 21.1° C.

2. May 2-11 was reported as the worst period of slime occurrence during the 1964 season for the Mayger, Eagle Cliff, and Wauna Drifts when the river discharge ranged from 184,200 cfs to 235,390 cfs, and the temperature ranged from 10° C. to 12° C. Some fishermen reported the slime problem during this period to be the most severe in many years. Some of them had to cease fishing entirely because their nets would sink, due to the large accumulation of slime. The picture on the following page, taken on May 6, 1964, shows the severity of the problem in this area.

3. The amounts of slime reported fluctuated during late July and August 1963 when the river flow was gradually decreasing. This variation is believed to be indicative of the effects of intermittent waste discharge.

4. During the February 25-28, 1964 period, troublesome slime was reported at the Mayger and Eagle Cliff Drifts, but the situation was not as serious as that encountered on May 2-11. The flow range at these drifts during this period was 169,460 cfs to 201,490 cfs with 5.6° C. temperature.

Also, reports during the September 14-25 period

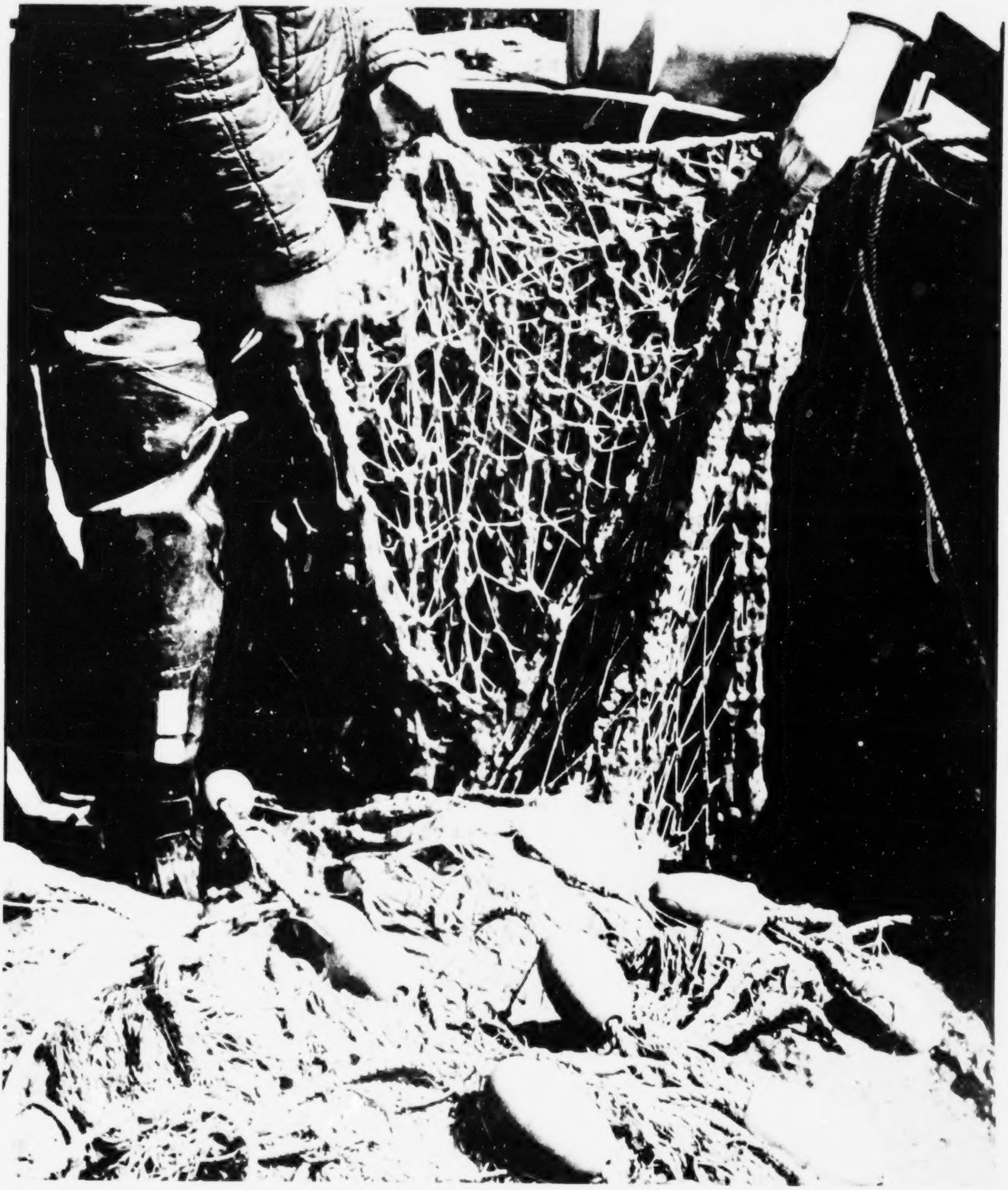

Photo by: Horn Photo
Clatskanie, Oregon, May 6, 1964

MASSIVE SLIME ACCUMULATION
ON COMMERCIAL FISHERMAN'S NET

indicated considerable slime occurring at the same drifts. The flow range during this period was 84,873 cfs to 132,203 cfs. River temperature ranged from 16.7° C. to 17.8° C.

5. The tabulation for the 1964 season shows that during the estimated periods when the Crown Zellerbach intermittent discharge was passing through the drifts, frequently the increased severity of slime was reported at the same time. The combination of low flow and tidal effect results in variable slime intensities in the lower river.

6. Generally, on the basis of the fishermen's reports, most of the slime was present about two or three feet from the bottom. This substantiates the conclusion of the German investigators that in large, deep rivers, about two-thirds of the living 'sewer fungus' (slime) occurs in the bottom water layers.

Details pertaining to the Columbia River discharge record for Bonneville, temperature data, and the commercial fishing seasons are included in Appendices D, E, and F, respectively.

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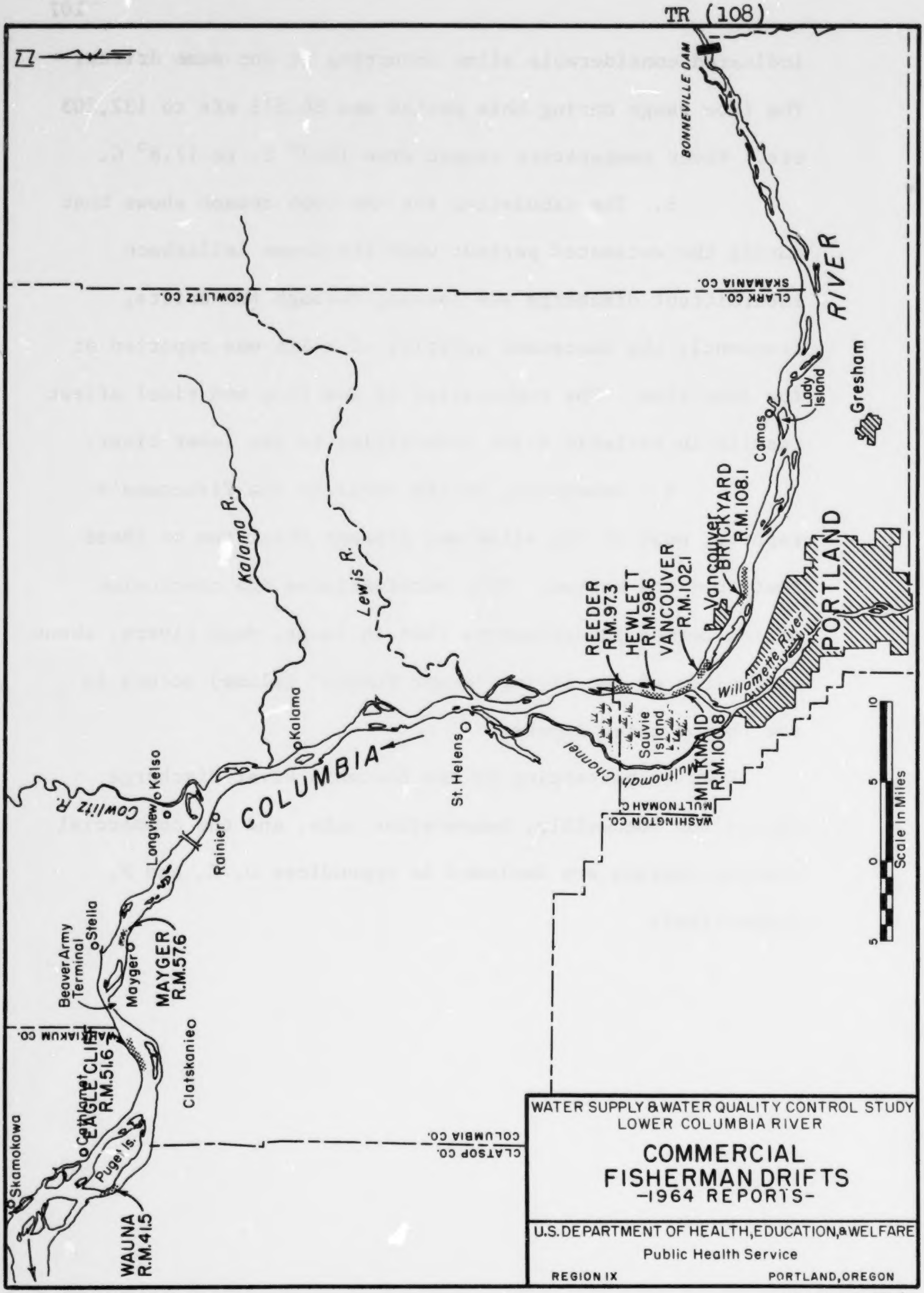

BONNEVILLE DAM
RIVER
SKAMANIA CO.
CLARK CO.
COWLITZ CO.
Lady Island
Gresham
Camas
BRICKYARD
R.M.108.1
Vancouver
PORTLAND
Willamette River
REEDER
R.M.97.3
HEWLETT
R.M.98.6
VANCOUVER
R.M.102.1
Sauvie Island
MILKMAID
R.M.100.8
Multnomah Channel
MULTNOMAH CO.
WASHINGTON CO.
Kalama R.
Lewis R.
Kalama
St. Helens
COLUMBIA
Cowlitz R.
Kelso
Longview
Rainier
Stella
Beaver Army Terminal
Mayger
MAYGER
R.M.57.6
WAHKIAKUM CO.
Clatskanie
EAGLE CLIFF
R.M.51.6
Cathlamet
Skamokawa
Puget Is.
WAUNA
R.M.41.5
COLUMBIA CO.
CLATSOP CO.
5 0 5 10
Scale in Miles

WATER SUPPLY & WATER QUALITY CONTROL STUDY
LOWER COLUMBIA RIVER

COMMERCIAL
FISHERMAN DRIFTS
-1964 REPORTS-

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Public Health Service
REGION IX PORTLAND, OREGON

FIGURE III

REDUCTION OF FIBER AND BOD LOADINGS

Two constituents present in pulp and paper manufacturing wastes discharged to the Columbia River contribute to the slime problem in the stream. Evidence indicates that slimes develop on suspended fiber discharged by the mills. There is also evidence pointing to the proliferation of slime growths due to nutrient contributions contained in mill wastes. Principally this concerns the carbohydrate fraction available in readily usable form. Similar slime growths may be encountered on smaller streams below points of sewage, canning, and milk-waste discharge where sugars may promote slime development.

The suspended fiber contained in pulp and paper mill discharges may be efficiently reduced in quantity by the provision of adequately designed sedimentation facilities. While several such treatment facilities are in operation in the Pacific Northwest, primary treatment for pulp and paper wastes is more commonly employed in other sections of the country. Installation of mechanically cleaned sedimentation facilities for treatment of pulp and paper wastes discharged to the Columbia River would remove the majority of objectionable wood fiber presently reaching the river in mill effluents.

The nutrient load, consisting of carbohydrate-type materials, is contained in a variety of wastes from the pulp and paper industry. The principal source consists of spent pulping liquors discharged to the stream. Chemical recovery from spent pulping liquors, employed by all but two mills on the river, also destroys the great majority of the nutrient load originating from the chemical pulping of wood. Both the Camas and Vancouver sulfite mills employ calcium base liquor and discharge all pulping wastes to the stream. In addition, spent sulfite liquor is barged to the Columbia River from a mill located at Oregon City, Oregon. A significant reduction in the nutrient load, as measured by BOD can be obtained by destruction or utilization of sulfite pulping solids produced at Camas and Vancouver, and elimination of spent sulfite liquor barged to the Columbia River.

The processes available to reduce BOD loadings from spent sulfite liquor consist of (1) recovery, (2) destruction, and (3) utilization. While recovery is practiced for retention of more valuable pulping chemicals, calcium is of little value to the industry. Evaporation of calcium base liquor, similar to Kraft recovery methods of burning for heat recovery, is a low-value utilization. This largely destroys the BOD load contained in pulping liquors. Utilization of calcium base liquor through yeast or alcohol production processes yields a salable commercial by-product. Evaporation and production of whole dried solids, or desugared solids from the yeast and alcohol process, produce commercial products of value. Fractional precipitation with lime is employed to yield recovery products of value for further processing. Each of these methods is presently employed by some calcium base sulfite mills in the United States, with resulting reduction in the BOD load discharged to the stream.

For addendum to this report, see Appendix D at the end of the transcript.

Appendix A

1964 SAMPLING EQUIPMENT AND PROCEDURES

Equipment and procedures used during the 1964 sampling program are as follows:

EQUIPMENT

The possibility that slime would grow on floating detritus rather than on the streambed dictated that sampling methods used in prior years be changed. The new sampling equipment was designed to be mobile and sufficiently flexible to collect large volumes of water samples at various depths and locations. A 25-gallon per minute (gpm), gasoline-driven pump was equipped with a 50-foot long, one-inch suction hose with the intake rigged to orient the inlet upstream. The pump was operated to deliver at least 125 gallons of water for filtration through a sampling net. Initially, a No. 12 bolting cloth (125 meshes/inch) net was used for filtering until a No. 20 bolting cloth (173 meshes/inch) net was found to be satisfactory. This equipment was mounted on an 18-foot boat powered with two outboard motors.

SAMPLING PROCEDURE

At a sampling station the intake device and hose were lowered to a selected depth by means of a steel cable mounted on a meter wheel. The pump was operated for one minute before initiating the sample collection with the net. The net was partly submerged in the river so that the energy from the discharge hose would be dissipated in the water rather than against the net. The elapsed sampling time (five minutes) was determined by either a stopwatch or a watch with a sweep second hand. The material collected on the net was washed from the outside to the bottom, and the contents were washed into a 16-ounce sample bottle. Ten milliliters of five per cent formalin solution were added as a preservative. The temperature of the water from the discharge hose was recorded during sample collection. In most instances, a sample of the water was collected in a 300 ml glass-stoppered bottle for Pearl Benson Index (PBI) determination. Stations were sampled from the boat by one of three methods: floating downstream with the current, anchoring to a fixed structure in the river, or holding the boat to a selected point with the motors.

SAMPLING LOCATIONS

Initially, the following stations were selected for cross-section and multiple-depth sampling:

River Mile

122.6, near Washougal
106.5, Interstate Bridge
99.3, Hewlett Point
83.8, Columbia City
62.7, below Longview

Sampling was also done in the Willamette River and Multnomah Channel below Portland Harbor. The sampling program was extended to include the Mayger area when an extreme slime problem developed.

1964 SAMPLE ANALYSIS

STATION	DATE & BONNEVILLE FLOW (cfs)	DEPTH (FEET)	TIME	TEMP. °C.	PBI (mg/1)	BIOLOGICAL ANALYSIS OF SAMPLE
122.6 A[1] (Washougal)	4/27/64	3 14	1504 1520	10.3 10.1		[4]
122.6 B[2] (Washougal)	142,900	3 9	1535 1550	10.0 10.1		[4]
122.6 C[3] (Washougal)		3 11	1605 1615	10.1 10.2		[4]
106.5 A (Interstate Bridge)	4/28/64	3 20	0812 0821	10.0 10.0		[4]
99.38 B (Hewlett Point)	141,100	3 29	1028 1040	10.1 10.1		[4]
83.8 A (Columbia City)		3 18	1230 1237	10.9 11.0		Wood fiber - sample lost in laboratory Wood fiber - sample lost in laboratory
W-0.2 (Willamette Mouth)	5/4/64 181,200	6	1432	11.2		Sample consisted almost entirely of algae (98%). Mostly planktonic diatoms, few filaments of filamentous forms. Few cast exoskeletons of microcrustacea, very few pieces of leaf & bark trash. No sand grains.
99.38 A (Hewlett Point)		30	1455	11.1		Most of sample consisted of sand grains. Of organic fraction, plant trash, bark fragments & small bits of groundwood comprise about 85%. Very few wood fibers. Remainder of river plankton, mostly diatoms.
99.23 C (Hewlett Point)		11	1512	11.5		95% algal plankton, mostly diatoms. A few filamentous algae. A few wood fibers (1-2%). Some plant & bark fragments, a few sand grains.
M-2 Multnomah Channel (¼ mi. below Sauvies Island Bridge)		30	1121	10.5		70-80% wood fiber & groundwood. No Sphaerotilus. 15% plant trash & bark. 5-10% river plankton & filamentous algae. Considerable number of sand grains.
W-27 (Willamette R. & Multnomah Ch. Junction)		15	1211	10.6		Mostly sand grains. 90% plant trash & bark fragments. 5% river plankton(diatoms). 5% live & dead microcrustacea(Clodocera & Copepoda). Very sparse sample, almost pure water.

STATION	DATE & BONNEVILLE FLOW (cfs)	DEPTH (FEET)	TIME	TEMP. °C.	PBI (mg/1)	BIOLOGICAL ANALYSIS OF SAMPLE
106.5 C (Interstate Bridge)	5/15/64	9	1335		27	
		17	1326		41	
		28	1316	12.5	24	
55.9 A_3 (Stella)	265,500	19	2000	12.3	41	40% wood fiber, 40% bark & plant debris. 20% Sphaerotilus-type organisms & diatom plankton (Fragilaria, Synedra, Cyclotella, Asterionella).
		19	2125		41	Same as above
		19	2230		45	Same as above
55.9 A_1 (Stella)	5/16/64 275,300	24.5	0708		63	Sample similar in appearance to above, except the growing Sphaerotilus is more abundant & the size of debris particles is larger. Considerable number of Copepoda (larva & adult).
55.9 A_2 (Stella)		20	0804		67	30% wood fiber, 30% bark & plant debris. 20% Sphaerotilus & other slime-forming bacteria. 15% diatoms in masses (Synedra, Fragilaria, Asterionella), 5% crustacean & insect exoskeletons, water mold mycelia. Fibers & debris stuck together by both bacterial slimes & diatoms.
		10	0815		70	30% wood fiber, 55% plant debris & bark. Fresh Sphaerotilus growing on fibers & debris. Many coarse sand grains. 15% plankton (diatoms & large sheets of Tetraspora).
55.9 A_4 (Stella)		15	1011		66	40% wood fiber, 55% plant debris & bark. Some fresh Sphaerotilus but less than preceding samples. Few sand grains. Some plant & animal plankton, but less than preceding samples.

STATION	BONNEVILLE FLOW (cfs)	DEPTH (FEET)	TIME	TEMP. °C.	PBI (mg/1)	BIOLOGICAL ANALYSIS OF SAMPLE
58.2 B (Mayger)	5/16/64 275,300	(Sample Taken From Gillnet)	1100			90% of the material scraped from the gillnet was of microscopic-size leaves, grass, small twigs, bits of paper. Of the microscopic fraction 80% was plant debris, 10% wood fiber & 10% Sphaerotilus & similar slime organisms. Very little plankton present & not much sand. When the gillnet was allowed to dry, most of the attached material crumbled & fell off on shaking. Nets covered with wood-fiber type slime are almost impossible to clean when dry, so this is not the kind encountered in the lower river.
55.9 C (Stella)		46	1205	12.5	63	85% fairly clean wood fibers. Small amount Sphaerotilus growing on some of them. Only a few strands of filamentous algae. Remainder of sample bark & plant debris.
55.9 A_7 (Stella)		15	1222		62	45% wood fiber, 45% trash & bark. Few filamentous algae, small amount plant & animal plankton, few small tufts of Sphaerotilus growing on trash & fibers.
55.9 A_6 (Stella)		15	1235		66	50% wood fiber, 45% trash, small amount plankton. Much microscopic trash (bark, leaf fragments, grass, etc.) in sample.
55.9 A_5 (Stella)		10	1430		60	45% wood fiber, 50% trash. Few plankton, small amount growing Sphaerotilus on trash and fiber.
55.9 A_7 (Stella)		10	1440		60	60% wood fiber, 35% plant debris & trash. Few plant & animal plankters. Some insect & crustacean skins.
83.8 A (Columbia City)	5/19/64 292,200	30	1030	13.0	58	80% wood fibers. No Sphaerotilus. Few water mold mycelia. 10-15% plant trash & bark. Fairly numerous plankton - Diatoms Synedra, Asterionella, Melosira; green algae Pediastrum, Closterium; Rotifers Filinia, Keratella; Copepods, Cladocerans.

STATION	DATE & BONNEVILLE FLOW (cfs)	DEPTH (FEET)	TIME	TEMP. °C.	PBI (mg/1)	BIOLOGICAL ANALYSIS OF SAMPLE
83.8 B (Columbia City)	5/19/64 292,200	21	1100		78	90% clean wood fibers. No slime, occasional strands of streptococci attached to wood. 5% of bark fragments, plant & green leaf fragments. Some large sand grains. Varied plankton present - Diatoms Fragilaria, Synedra, Melosira, Asterionella; Desmid Closterium; Rotifers Anuraea, Trichotria, Kellicottia; Copepods; Cladocera.
M-6 (Multnomah Channel @ St. Helens)		10	1215	13.3	149	95% clean wood fibers. Almost no slime or bacterial growth. A few streptococcus chains. A few Phycomycetes water mold mycelia. A few small bark fragments. Some sand grains, not adhering to the wood fibers.
M-B (200 yds. downstream of previous sample)		35	1228		95	80% wood fibers. Mostly clean, but tufts of Sphaerotilus growing on some fibers. Some water mold mycelia. Some plankton present as at upstream sampling stations, but much reduced in quantity. Numerous filamentous algal strands, probably from log rafts.
M-7 (Halfway between above 2 stations)		5	1250		125	Essentially as above. A few Copepods present.
		12.5	1256		99	- Same -
M-5 (Water intake & St. Helens Mill)		13	1325		98	80% clean wood fibers; 10% bark particles & plant fragments. Abundant plankton-Diatoms Fragilaria, Melosira, Synedra, Asterionella; Desmid Closterium; Rotifers Collotheca, Anuraea, Filinia, & others; many Copepods & Cladocera.
M-3 (Scappoose Bay)		12	1343		119	85% wood fibers. Appear to be much older & much more beaten up than those from samples close to mills. No Sphaerotilus. Few Diatoms & Desmids. Rotifers, Cladocerans & Copepods fairly numerous. Some filamentous algae (Ulothrix & Spirogyra).

STATION	DATE & BONNEVILLE FLOW (cfs)	DEPTH (FEET)	TIME	TEMP. °C.	PBI (mg/l)	BIOLOGICAL ANALYSIS OF SAMPLE
W-3.7 (Willamette River near Terminal #4)	5/19/64 292,200	45	1528		105	Small amount clean fiber. No Sphaerotilus or other slime organisms. Fair amount plankton, mostly zooplankton - Cladocerans, Copepods, Nematodes, Rotifers. Numerous strands of filamentous algae.(Ulothrix, Spirogyra, Tribonema), few Chironomid midge larvae.
M-1 (Multnomah Channel above Sauvies Is. Bridge.)		20	1545		94	Few clean fibers (60% wood fiber, 40% plant debris). Many large sand grains. Some zooplankton, mostly Cladocera, Copepods. Very few plant plankters.
105.8 C (Between RR Bridge & Boise-Cascade)		20	1617		7	95% clean wood fibers. A very few small knots of living Sphaerotilus growing on some fibers. Very little animal or plant plankton, mostly Rotifers & a few strands of filamentous algae.

1/ Oregon side

2/ Center

3/ Washington side

4/ A very small amount of sand and leaves was collected in the sample. No fibers or slimes were observed. The sample was not saved for laboratory analysis.

Appendix C

EXPLANATION OF RIVER EVALUATION PROCEDURES

GENERAL INFORMATION

In order to evaluate the fishermen's complaints obtained on the Lower Columbia River to date, all data, including the fisherman reports, river discharge, and temperature were tabulated for the period 1960 to the present. The fisherman reports were first analyzed on the basis of date, drift, general slime conditions, and river discharge. The most consistent reporters were those fishing at the Eagle Cliff (R.M. 51.6), Mayger (R.M. 57.6), and Wauna (R.M. 41.5) Drifts; however, a number of reports were received from upriver fishermen in the Vancouver-St. Helens area.

On the basis of reports of severe slime conditions received during the 1964 fishing operations, it was decided to examine in more detail all the fisherman reports. In so doing, an effort was made to correlate the fishermen's complaints with Crown Zellerbach Corporation's lagoon waste discharge periods, river temperature, river discharge, and tidal effects. (The latter item was examined particularly in the lower river areas where it has the greatest effect on fishing operations.)

CROWN ZELLERBACH WASTE DISCHARGE PERIODS

In order to relate the Crown Zellerbach 'slug' periods with complaints from downstream fishing drifts, it was necessary to have some idea of the time of water travel from Lady Island outfall to the drifts for various river discharges. Due to the complex tidal problems encountered in the Lower Columbia, an accurate determination of time of travel is very difficult; however, a good estimate can be made. For the purposes of this report, the following estimate was made: A graph was constructed of time of passage versus river mileage from Lady Island outfall for various river discharges, using the flow equation $Q = VA$; where Q = discharge, V = average river velocity, and A = river cross-sectional area. This graph represents the standard flow curves and excludes all tidal effects, but it does give a good estimate of travel time, particularly in the upper reaches.

Travel times taken from this graph were compared with the actual times observed in a Crown Zellerbach Corporation publication (12) and were found to compare favorably at similar river discharges. Next, daily flows of all the major tributaries of the Willamette and Columbia Rivers were averaged over a three-year period, 1961-1963, on a monthly basis in order to estimate the inflows to the Columbia at various locations in the study area. These inflows were then added to the daily recorded Bonneville discharges at their respective influences to account for all ungaged Columbia discharge. To give an accurate estimate of discharge travel times, the total Columbia River flows were averaged over four-day periods beginning with the first day of Crown Zellerbach lagoon waste discharges. Using this procedure, time of travel was generally estimated in three stretches of the river below Lady Island outfall: Lady Island outfall to Willamette River mouth, Willamette River mouth to St. Helens, and St. Helens to the lower drifts. The estimated travel time required for Crown Zellerbach lagoon 'slugs' to reach and traverse the fishermen's drifts was determined in this manner.

RIVER TEMPERATURE

Since the fishermen do not report river temperatures at their drifts, the exact daily temperatures are not available, but the daily Columbia River temperatures at Bonneville Dam are tabulated. The recorded temperatures at Bonneville Dam were compared with those observed in the lower river at the Clatskanie, Oregon, WPSS station, and the difference was found to be small. For the purposes of this report, Bonneville temperature recordings have been used.

RIVER DISCHARGE

Recorded river discharges at Bonneville Dam have been used throughout this report. As was previously stated, the estimated ungaged readings have been added when necessary to determine more accurately flows at the drifts.

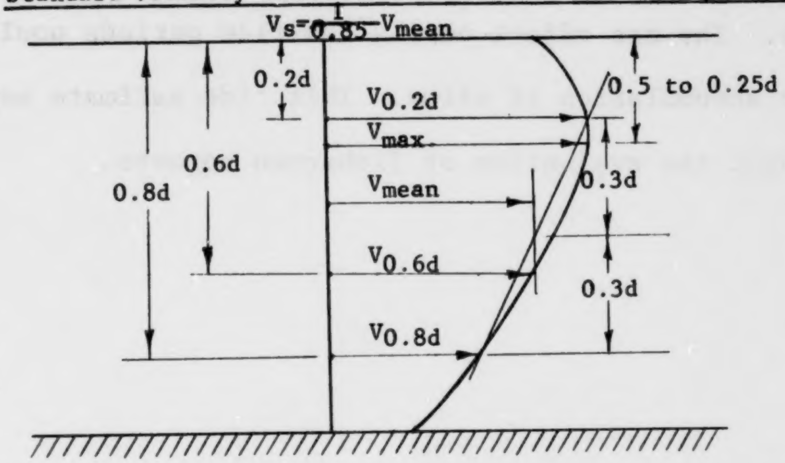
TIDAL EFFECTS

Tidal effects at the lower drifts, in particular at Beaver Army Terminal, were estimated. Generally, determinations at Beaver Army Terminal were indicative of the tidal fluctuations at the Mayger, Eagle Cliff, and Wauna Drifts. The estimation of tidal effects is based on information obtained from the U. S. Army Corps of Engineers report entitled 'Review Report on Columbia and Lower Willamette Rivers Below Vancouver, Washington, and Portland, Oregon,' with particular emphasis on their '1959 Current-Measurement Program Interim Report.' Tidal height, tidal velocity, and river discharge data were obtained for a selected nine-day period during each of the months of May, June, and September 1959. With this information, an idea of the over-all tidal fluctuation occurring at maximum,minimum, and average river discharges was obtained. Also, the 1959 tide information would be similar to all yearly tide effects. A graph of tidal velocity versus tide amplitude was constructed for the Beaver Army Terminal area. Next the daily mean and diurnal tide ranges and their respective tidal velocities were computed for 1963 and 1964. Since the mean tidal range is the average of all daily tidal ranges and the diurnal range is the average range of the daily maximum tides, an idea of the worst tidal conditions that could occur and an idea of the average daily tidal conditions that could occur are known.

Then, the velocity due to river discharge at the Beaver Station was compared with these tidal velocities. When the tidal velocity becomes greater than the average river discharge velocity, there are virtually complete stoppage and reversal of the river flow. Using this procedure, it was estimated that generally all river flows at Beaver Station below 220,000 cfs would be stopped or reversed by tidal velocities on the incoming or high tides. On the ebb tide there would be a rush of water downstream. Hence, at all river flows in the Beaver area below 220,000 cfs there is a tidal stoppage or reversal of river flow during the high tide period. This period of ceasing flow could vary from one to six hours.

In order to more clearly understand the slime problem during these periods of tidal stoppage and reversal of river flow, the following plot of the standard velocity distribution in a river such as the Columbia is introduced:

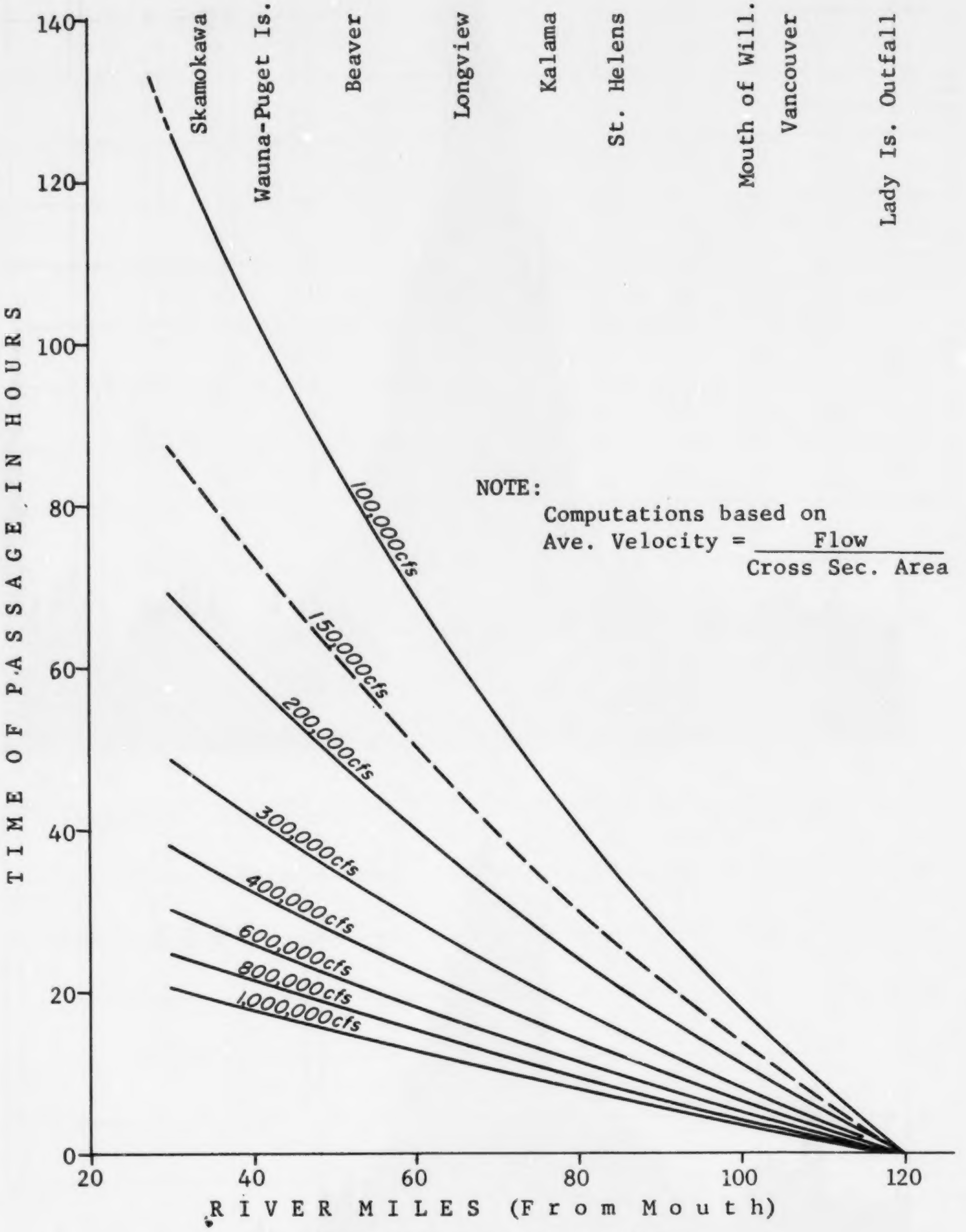
Standard Velocity Distribution in a Vertical in Open Flow (17)



It is noted the average velocity occurs at approximately 0.6d below the water surface. All river velocities at layers below this depth become increasingly smaller, and at the very bottom of the river the velocity is approaching zero. During periods of river discharge in which the high tide ceases and reverses the flow, it is felt that the slimes settle to the lower velocity layers and on the ebb tide these slimes are flushed downstream, but at a slower rate than if they had remained in the upper velocity layers. Furthermore, as the average river velocities decrease, the depths at which these velocities occur more nearly approach the bottom layers of low velocity. Consequently, larger amounts of slime will be transmitted to the lower velocity layers. Also, since the duration of the high-tide period at the lower flows is greater than at high flows, the slimes will have more time to settle to these lower velocity

C-6

layers. Therefore, it is concluded that the tidal fluctuation will have its greatest effect on the slime problem during periods of low river flow. As was mentioned earlier, the critical flow would be approximately 220,000 cfs at the lower drifts. The net effect during low-flow periods would be a greater accumulation of slime. This tide estimate was used throughout the evaluation of fisherman reports.

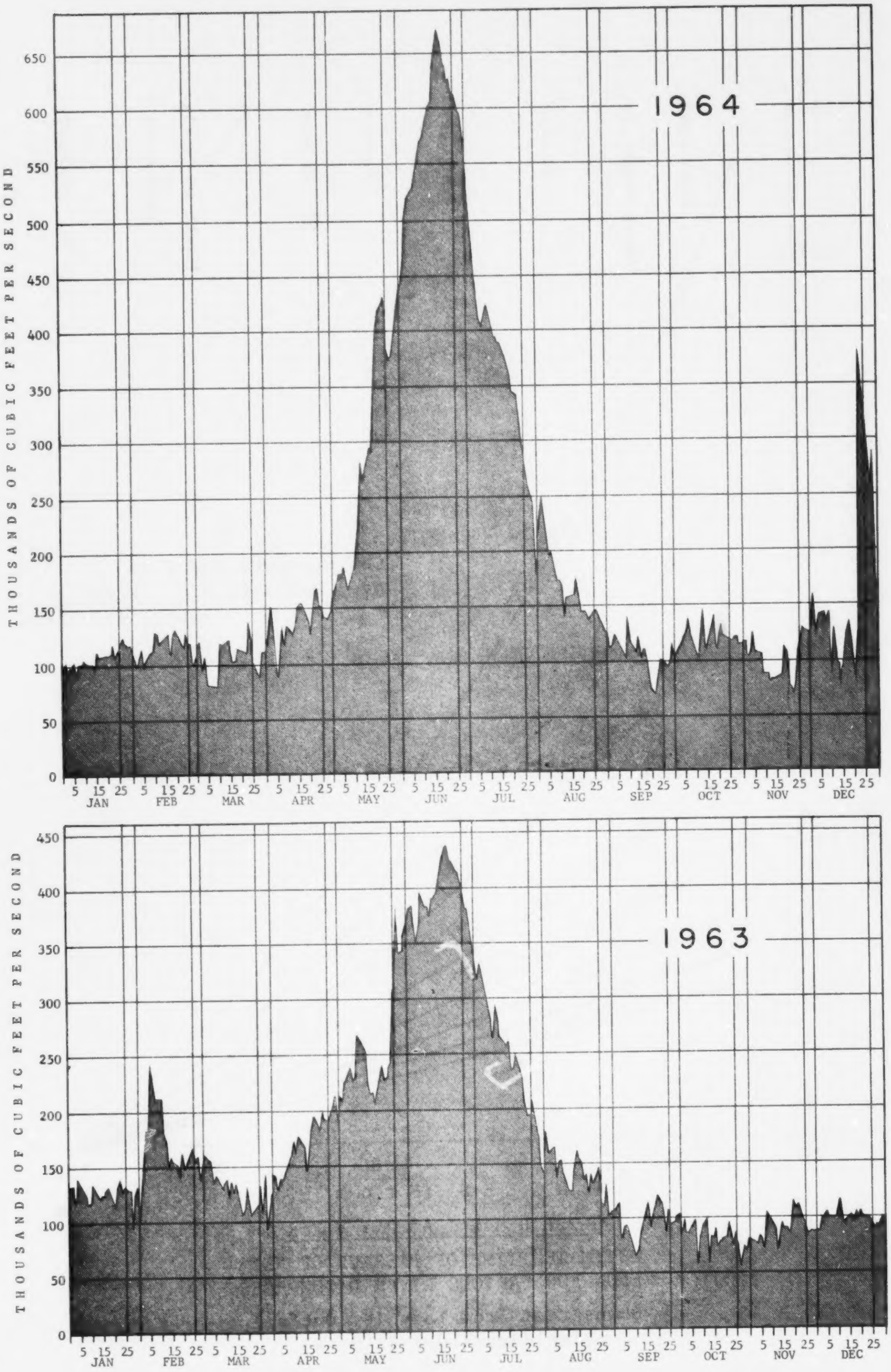


NOTE:
Computations based on
Ave. Velocity = $\frac{\text{Flow}}{\text{Cross Sec. Area}}$

COLUMBIA RIVER

ESTIMATED TIME OF PASSAGE OF NET*
FLOW FOR VARIOUS RIVER DISCHARGES

Downstream From Lady Is. Outfall
*Excludes Tidal Effects



COLUMBIA RIVER DISCHARGE
AT BONNEVILLE DAM 1963–1964

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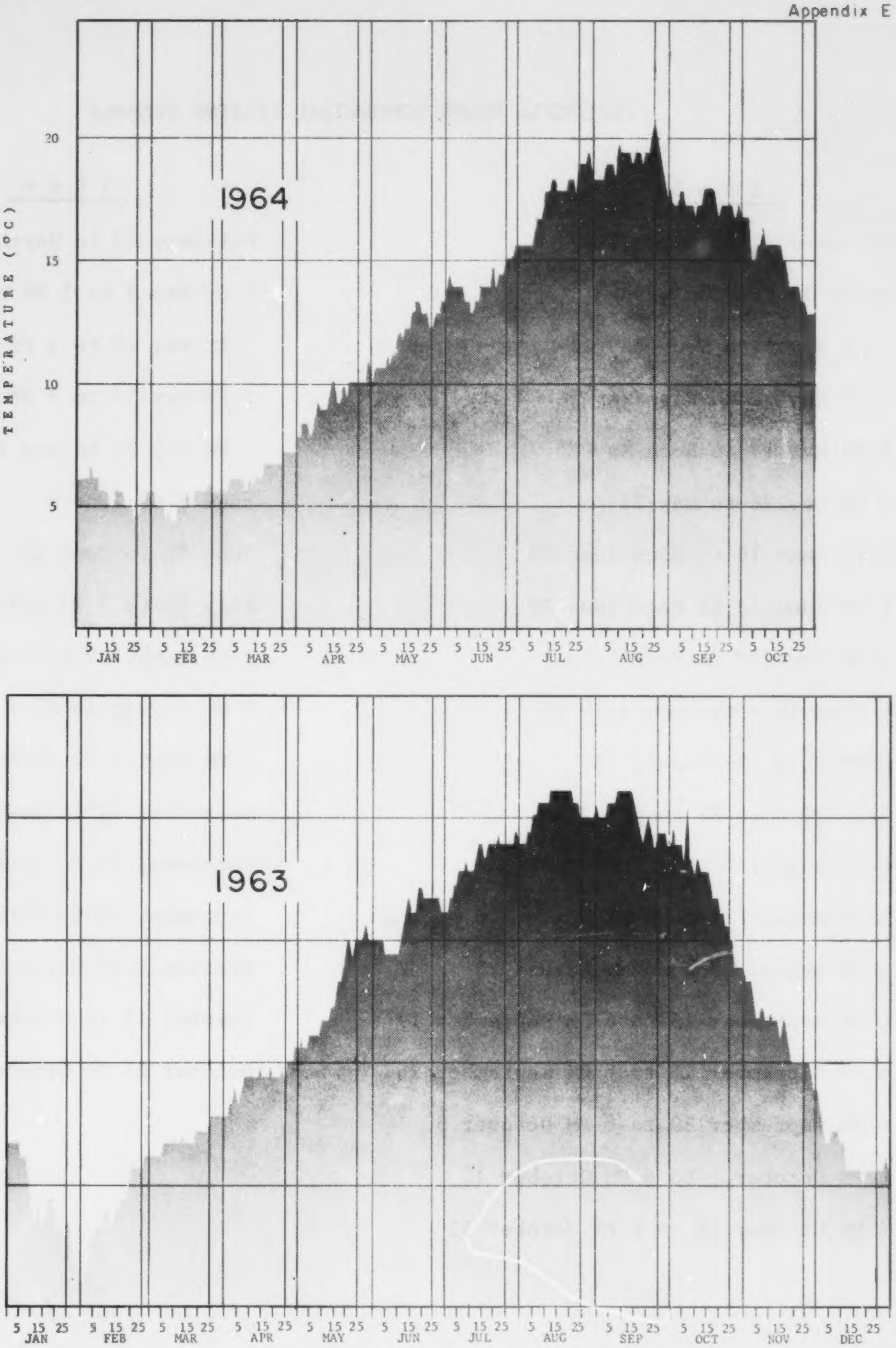

COLUMBIA RIVER TEMPERATURE
AT BONNEVILLE 1963-1964

Appendix F

COLUMBIA RIVER COMMERCIAL FISHING SEASONS

1963

February 15 to March 1
April 30 to Noon May 4
6 PM May 5 to Noon May 11
6 PM May 12 to Noon May 18
6 PM May 19 to Noon May 25
6 PM May 26 to May 27
6 PM June 16 to Noon June 22
6 PM June 23 to Noon June 29
6 PM June 30 to Noon July 6
6 PM July 7 to Noon July 13
6 PM July 14 to July 15
July 29 to 6 PM August 2
6 PM August 4 to 6 PM August 9
6 PM August 11 to 6 PM August 16
6 PM August 18 to 6 PM August 23
6 PM September 16 to 6 PM September 19
6 PM September 23 to 6 PM September 26
6 PM September 30 to 6 PM October 3
6 PM October 7 to 6 PM October 10
6 PM October 28 to 6 PM October 31

1964

February 15 to March 1
7 PM May 3 to 1 PM May 9
7 PM May 10 to 1 PM May 16
7 PM May 17 to 1 PM May 23
7 PM May 24 to May 27
June 6 to June 9
June 22 to June 24
July 29 to 7 PM July 31
7 PM August 2 to 7 PM July 31
7 PM August 16 to 7 PM August 21
7 PM August 23 to August 25
September 14 to September 18
September 21 to September 25
September 28 to October 1
October 5 to October 8
October 12 to October 15
October 26 to October 31

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CHAIRMAN STEIN: Mr. Poston, would you continue?

MR. POSTON: Invitations to some 14 Federal agencies who are involved in some phase of water or land resource development were asked to attend this conference and were offered an opportunity to make a statement if their interests were directly involved with the matter of pollution.

We have heard from all of the agencies, and three have indicated a desire to make a presentation.

I will now call on the Department of the Army, Mr. Rockwood.

CHAIRMAN STEIN: By the way, it would be helpful if any of the participants, to the conferees, especially to the reporter, if the participants have a prepared copy of their statement, to make it available. I think the first one who should have priority is the reporter, because I know what a chore it is to keep this up all day and just take this without having a copy to refer to. And if there are any more, we would like to have them at the table following. If you just have one, let the reporter have it.

MR. ROCKWOOD: Thank you, Mr. Poston, and ladies and gentlemen: My name is David Rockwood, and I am here representing the North Pacific Division office of the Corps of Army Engineers, and I have a statement prepared that I would like to present at this time.

The Corps of Engineers has a direct interest in many phases of river development problems in the Lower Columbia River, including those associated with the matter being discussed here today, namely, that of the pollution of the Lower Columbia. There are several major areas of pertinent engineering investigation, construction and river regulation that are being carried on by the Corps, including the following:

The first one in this category is water resource planning studies for the Columbia River and tributaries.

The second element is the design and construction of major water control projects for multiple-purpose use.

The third item is project operation on a day-to-day basis for multiple-purpose water uses, including flood control, power, navigation, irrigation, pollution abatement, recreation, fish, and other related areas.

Our fourth area of interest is involved in that of channel stabilization and improvements in the interest of navigation, particularly with regard to the 40-foot channel for the Lower Columbia River, now under construction.

Our fifth area of interest is that involved with engineering and hydraulic model studies of the Lower Columbia River, and the estuary of the Columbia.

I do not wish to take the time today to go into detail on each of the above items. I would like to emphasize, however, certain aspects of these elements that may be of particular interest to this group.

For planning purposes, the Corps is continuing system regulation studies for determining power and related water use capabilities for the Columbia River system of dams and reservoirs. Studies of this type have been performed by digital computer model simulation techniques over the past 10 years. Results give streamflow conditions in the Lower Columbia River that would be expected under a variety of conditions of reservoir development, for the historic streamflow record of 1928-1958. Computer application to reservoir regulation studies are also being applied to flood regulation studies, to day-to-day flood forecasting, in cooperation with the U. S. Weather Bureau River Forecast Center, and for hourly power poundage operating studies for the main stem Columbia dams and reservoirs. Reservoir effects on water temperature are also being studied by Corps of Engineer offices in this area.

Operation of the existing system of reservoirs on the Columbia is primarily in the interest of flood control, power, navigation, irrigation and other water uses. Included in these uses is the release of water for augmenting low flows in the interest of pollution abatement, as is done every summer in the Willamette River Basin. In the Lower Columbia River, however, the streamflow during July and August is well above the annual mean flow, and reservoirs are held full until the low-flow period. Accordingly, there is little opportunity to augment Columbia River flows during the late summer in the interest of pollution abatement, but winter-time stream flows may be increased as much as 100% above the natural flow, under present conditions of development.

I would also like to mention the work presently underway at the Bonneville Hydraulic Laboratory on making a movable bed hydraulic model of the Columbia River below Vancouver. It is anticipated that the sections between River mile 53 and 78 will provide usable data on stream beds and currents within the next year, under improved conditions for the 40-foot channels. This model will be available for investigations of this type for the next 20 to 25 years.

In summary, we in the Corps are interested in developing water control projects to make full use of our water resources, including pollution abatement. It is our hope that those concerned primarily with pollution control can make use of the engineering studies outlined above.

Thank you very much for your time.

CHAIRMAN STEIN: Thank you very much, Mr. Rockwood, for a comprehensive statement of the Corps's activities.

As many of you know, the Corps is under the Department of Interior as is Agriculture -- are our major sister agencies in Federal water resource development. As a matter of fact, the Corps and we have the distinction of being the two water agencies that go before the state committees. So we are indeed rather close.

Are there any comments or questions from Mr. Rockwood? If not, thank you very much.

Mr. Poston.

MR. POSTON: Next, I would like to have us hear from the Department of Interior, Bureau of Commercial Fisheries.

I have seen Dr. Ed Perry in the crowd. I suppose, as usual, he would be their spokesman.

CHAIRMAN STEIN: Is John Biggs here?

MR. PERRY: My name is L. Edward Perry, Program Director of the Columbia River office here in Portland of the Bureau of Commercial Fisheries.

I will follow, generally, this statement that I have handed to you a minute ago.

Recognition of pollution in the Columbia River is not of recent origin. The controversy over waste disposal has been a public issue for many years. We have been told each year of the progress in pollution abatement, but each year we are also bombarded with complaints by commercial and sport fishermen regarding the fouling of their nets and lines from Sphaerotilus and associated slimes. The incidence of Sphaerotilus is particularly acute in the area downstream from the Interstate bridge at Vancouver, Washington, and also immediately below the confluence of the Willamette and Columbia Rivers.

The solution to this problem appears to us as a "slimy mirage" -- always in sight but never quite reached.

Of recent years, the Bureau of Commercial Fisheries has spent over 40 million dollars in the Columbia Basin, and over one-half million dollars in the Willamette River drainage building fish ladders, clearing log jams and planting salmon and steelhead in cooperation with the State Fish and Game agencies. We plan to contribute nearly two million dollars for the construction of new fishways at Willamette Falls. All of these expenditures have been predicated on the correction of the pollution block that has existed in the Portland area and has exterminated fall runs of chinook salmon that formerly used this river system and prevented the establishment of new runs. Our hopes were high as water quality slowly improved. Perhaps our optimism was premature as some chinook caught in the Willamette this spring tasted as though they had been marinated in phenol, and this summer we are again faced with oxygen deficiencies in the Portland harbor. Only emergency measures are saving the fall run of fish which we, with the State Fish and Game agencies, have so tediously reestablished or we are reestablishing.

Pollution in the Willamette is severely restraining the last big potential salmon production of the Columbia Basin. Many miles of good spawning area for fall chinook will be available as soon as a new fishway at the Oregon City falls is completed and the water quality of the lower Willamette is improved to allow passage. The value of this potential is estimated at $3.4 million. These fish in particular are vulnerable since they enter the Willamette during late summer when pollution has its greatest effect.

We recognize the problem of waste disposal is complex, and complete abatement measures cannot be implemented in a day, but our gains are painfully slow. Too often the fishery resources have suffered for fear of offending domestic and industrial polluters. Too often we have been asked to pay with the loss of a fish run because of the difficulty of getting the waste disposers to change their procedures. If we continue to struggle along, agreeing to compromise with inadequate action, the fish resources will be seriously damaged, possibly beyond full recovery.

The custom of transporting wastes from the Willamette System to the Columbia River for greater dilution in a large body of water should be stopped. The Public Health Service reports, as you just heard, that in the Columbia River the pulp and paper industry imposes an organic load six times as great as that from all other sources combined, and this is increased to more than 28 times during the once-a-week discharge from one holding pond.

The oxygen content in the salmon and steelhead waters of the Columbia Basin should be maintained at a high level of at least 7 parts per million and under no circumstances should they be permitted to drop lower than 5 parts per million in extreme conditions.

The Bureau of Commercial Fisheries endorses an early adoption of a pollution abatement program to take immediate action in known danger areas such as the lower Willamette River and the Sphaerotilus zones in the Columbia River. We support the recommendations of the Public Health Service report that remedial facilities should be completed at all paper mills no later than December 31, 1967. Further, we ask for an acceleration of research to clearly define the total Columbia River pollution problem to facilitate its eventual solution.

Thank you.

CHAIRMAN STEIN: Thank you. Are there any comments or questions? If not, I have two. You talk in terms of a potential -- if the fishway at Oregon City falls is completed -- estimated at $3.4 million. What is that -- an annual or a generalized figure?

MR. PERRY: That's an annual figure; that relates to fall chinook only. There are potential values of other salmon, steelhead that will be aided by this fishway in the improvement of the water qualities.

CHAIRMAN STEIN: Thank you.

Mr. Spies.

MR. SPIES: Dr. Perry, yesterday in the Portland harbor with a flow of only 5300 second feet, the oxygen demand reading 4.6 and 5.8, would you consider those as adequate for the upstream migration of this species of fish?

MR. PERRY: You are trying to pin me down to 4.6 as a very small margin from 5.0 -- why not take 4.6? I feel that this is perhaps an academic question when you get right down as to what a fish will take.

We know that fish are different individuals. Some can take more, some can take less. Our standard of 5 parts per million has been pretty well accepted every place I have been associated, and I feel that I'd rather stand on 5 parts per million as the absolute minimum we should accept here.

MR. SPIES: My point in bringing this up is simply this: that there's been so much publicity recently about the disgraceful condition of the Willamette River; we contend that it is not disgraceful, that we are making very acceptable progress, and that we now have conditions which will support the upstream migration of fish. Our goal is 5 parts per million also, and we will be reaching that very shortly; but at the present time, again, contends we have conditions which they will support the migration of fish.

MR. PERRY: The improvements we have encountered here in the last couple of weeks has been commendable; there is no question about it. But we had at the end of July 1.6 parts per million, which is not acceptable by anybody, and I believe your own staff agrees with this. We have been able to raise it, through your efforts, the Public Health Service, in cooperation with the mills and the Corps of Engineers, to bring it up to the point you report here this morning, which I think is very commendable; there is no question about it.

If we could keep it like this every year, I think we would be quite happy. As a figure, I'd like to see 5 parts per million as an all-time minimum, and, when runs are migrating, I'd much rather have 7 parts per million. I'd much rather see it.

MR. SPIES: Thank you.

MR. POSTON: Mr. Chairman, I have one question I'd like to raise. Reference has been made here to chinook caught in the Willamette this spring that tasted as though they had been marinated in phenol.

Would you care to go into this in a little more depth? Are we liable to have this situation develop again, or would you care to tell us more about it, Dr. Perry.

MR. PERRY: I'm afraid I don't know too much about the cause of this. We have had to refer to you fellows for details. We had numerous reports from fishermen that complain about the bad taste in the salmon. I understand the Public Health Service did some analysis; I am not acquainted with the results. I can assume that if we have conditions continuing as they are or as they were this spring, we could have another occurrence expected repeatedly of such foul-tasting.

MR. POSTON: If this did re-occur, what would you estimate the probable damage to the commercial fishery would be, to spoil a sun of fish?

MR. PERRY: I would guess this would be more of damage to the sport fishery up here in the Willamette, because this occurred in the adult fish. That's where it's tasted. I doubt, if anything, it would taint the flesh of a small fish, going down to the commercial fishery and coming back as adults, and still taste it.

This would affect the sport fishery, I'm sure. In fact, I talked personally with a number of sport fishermen that said they didn't care whether they caught any fish this spring if they were going to taste like those that were caught. I don't mean that the fifteen thousand or so fish that were caught this spring, that they all tasted this way. There were enough, that there was a lot of comment about it.

CHAIRMAN STEIN: Any further comments or questions? I have one clarifying question, Dr. Perry: We have a hectograph statement, and there was one sentence you omitted from the end of the first paragraph. Do you mean that to be omitted, the last sentence?

MR. PERRY: That does not need to be omitted. I skipped over it. I rearranged a couple of locations.

CHAIRMAN STEIN: We caught your other sentences that you rearranged, but this one was left out.

MR. PERRY: You can leave it in. It doesn't have much meaning anyway. I just skipped over it.

(The sentence referred to is as follows:

> "This latter area is used for the disposal of wastes from industries near Portland and is often called a 'dilution zone' by those who defend this practice.")

CHAIRMAN STEIN: All right. Are there any further comments or questions? If not, thank you very much.

MR. POSTON: I would like to now call on the Department of Commerce, Weather Bureau, who has asked to make a statement this morning.

Is the Department of Commerce here?

MR. FERRIS: I think they originally asked they be included in the afternoon, if possible.

MR. POSTON: The afternoon?

MR. FERRIS: Yes, early afternoon.

MR. POSTON: I would then ask if there are any other Federal agencies that have changed their mind and want to speak at this time. If not, Mr. Chairman, this concludes the presentation by the Federal agencies.

CHAIRMAN STEIN: We will give you a reservation if you get the Weather Bureau to show up this afternoon. Since they produced a day like this for Portland, I don't blame them for not coming. (Laughter)

Before we recess, I want to remind those again from Oregon and Washington who wish to participate to see Mr. Spies for Oregon and Mr. Harris for Washington, and make their arrangements.

With that, we will stand recessed for about fifteen minutes. Just one moment.

MR. HARRIS: Collectively, I would like to have all of our state legislators stand up. I just noticed we have quite a number of interested spectators in here from the Washington legislature.

Would you please rise? (Applause) Thank you very much for your interest.

CHAIRMAN STEIN: Thank you. With that, we will stand recessed for about fifteen minutes.

(Whereupon a fifteen-minute recess was taken.)

CHAIRMAN STEIN: May we reconvene? Our present plans call for a luncheon recess at about 12:00 or as close to there as we can conveniently find a breaking point, and then a reconvening at about 2:00.

At this point, we would like to call on Mr. Spies of Oregon.

Mr. Spies.

MR. SPIES: Mr. Chairman, conferees, ladies and gentlemen: Before the state of Oregon submits its official statement, I wish to call on Mr. Robert Straub, Treasurer of the state of Oregon, who would like to make a statement on the general subject of water pollution control.

Mr. Straub.

MR. STRAUB: My name is Robert W. Straub, Treasurer of Oregon, an elective office.

Mr. Chairman, Mr. Spies, Mr. Harris, members and delegates to this very critical conference on water pollution: I am here for two reasons. One is because I think that in the ultimate solution of pollution on our streams, there must be involvement of the political consideration as well as the technical data.

You people are able to achieve what you know should be achieved, can be achieved, only if those who are privileged to hold elective office are willing to support you in your work, and, in fact, are willing to clear out of your way the political burdens and barriers and interferences that often prevent you from accomplishing the goals of clean streams and pure water that you know are desirable.

I am also here because I recognize, as many other people do, that we are almost at the point in our nation's history where water is our most vital, our most valuable, our most precious natural resource nationwide.

We are all aware of the crises and the emergency conditions that are being created in the East today because of the leaders in the East in years past ignoring this problem and failing to take the necessary measures that would have anticipated and alleviated the problems that they now have.

We in the Northwest are perhaps the last frontier where we have the opportunity to create or to preserve, if you will, a highly desirable, attractive living climate.

Many have admonished us that perhaps as we look ahead to the long-range economic development of the Northwest, that the most priceless heritage that we have are our natural resources and the beauty and the purity of those resources.

As recently as a month ago, a man who is no dreamer, a man who is a giant in the industrial world of the West, Mr. John Beckett, the president of the Transamerica Corporation, spoke right here in Portland, Oregon, and said that, "America is putting a higher and higher premium every day on clean water and on clean air, on adequate opportunities for invigorating restful recreation." And he went on to admonish those who were listening and those who are interested that in this direction lay the real secure, significant economic future for Oregon and Washington; and I am here today to say "Amen" to that. I am here today because I recognize, as you people do, that the challenge, the need, the demand for preserving clear water, pure water, both for industrial use in the future, for agricultural use in the future, and for municipal use in the future, and as a background and as a necessary corollary for the increasingly important area of outdoor recreation that this conference that you are having here today is probably as vital and as significant and as important a conference as any that has been held in Oregon this year.

I want to make the observation that I am not here today in any sense in pretending or presuming to have any technical competence or judgment.

You are the people with the technical knowledge; you are the people who can make the evaluations about the stream flow, the oxygen count, the amount of toxicity that water should have, the cause and the problem of the slime control. This is your job; but I submit that in the realization of a high level of water purity and water control, that the fulfillment of these goals does require this joining hands between you people who have the technical knowledge and those of us who have the political knowledge and the political interests and have a responsibility to support you and back you up in the very important and the very difficult and the very trying work that you are attempting to do.

I want to urge that as we meet today and as we think about what we should be doing, that you in the technical field should not make small plans; you should not continue to operate on a low level for fear of the political impossibility of doing more.

I think that both those of us who have some position of influence with the public and hold political office, and you people who have the job of cleaning up our rivers, have perhaps both been a little derelict, perhaps both have been a little bit hesitant and timid and reluctant. And I am beginning to believe that perhaps the average, ordinary citizen is ahead of both of us, and I am beginning to believe that perhaps the public is willing to support and is willing to accept the necessary measures beyond what we have felt they were willing to do.

One argument that is often heard in the subject of the difficulty of translating, identifying, the difficulty of one state moving boldly, moving adequately with effective pollution measures, is that for one state to do it and to act on its own is going to drive into the arms of the neighboring state across the river that industry which the restrictions are being imposed upon.

Certainly this could be a device that one state could use, opening its arms and opening its borders to attract industry at the disadvantage of its neighbor. And I believe that a way, an appropriate and effective way to prevent that, is to consider the creation of a regional Columbia River water purity compact so that the whole river basin drainage area is treated by the same laws and the same degree of enforcement, so that there cannot be this industrial jockeying or this industrial bargaining back and forth, using the degree and the intensity of pollution enforcement as one of the means of luring industry in.

I think that a regional Columbia River pure water compact could move more adequately and more effectively in correcting the pollution that we now have, succeeding in closing the ring and doing away with the need for correction; and it could also do more effective work in the area of prevention, which is the area I hope we will be able to move into within a few years.

Unquestionably, the greatest demand for fresh water in the next fifteen years will be in the industrial field.

A recent report by the U. S. Bureau of Public Health shows that during the next fifteen years the demand for fresh water by the new type of industry that we are getting in this country will increase 146 per cent.

Ladies and gentlemen, this increased use of water by industry is more than double what will be the increased use of water by the combined demand of both the municipal and the agricultural needs.

I think that only as a means of preserving our future industrial growth in Oregon, we need to move with vigor; the public will support stringent measures to clean up our water. Our ability in Oregon and certainly your ability in Washington to continue to enjoy an industrial growth will require that we do have the clean water to handle the growth.

I was very pleased to notice in the papers last week that Senator Ribicoff, who previously was Secretary of Health, Education, and Welfare, a man certainly as well versed in the need for pollution control as anybody in the nation, introduced a bill in Congress which would quadruple the Federal appropriation in the area of water and air pollution control.

I think that we should take leadership and we should read meaning into the concern that Mr. Ribicoff has in this area, and I hope that we in Oregon and you in Washington can do more than has been done in the past to continue to move in the direction of cleaning up our river.

An old Indian legend about the Columbia had it that the shores of the Columbia were lined with gold sand, and this lure of wealth is what drew many of the pioneers and the early explorers to the Pacific Northwest, only to find that the legend was an illusion; but I think I'd like to close my remarks by observing that, perhaps, time is almost here when the uninterrupted magnificent flow of the Columbia River wild will prove of higher value than if it, in fact, had been lined with sands of gold.

It's your job, it's my job, and it's the job of other people in the political arena to join hands to see to it that we achieve and succeed in making that water clean water.

Thank you. (Applause)

CHAIRMAN STEIN: Thank you, Mr. Straub. Are there any comments or questions?

I think, Mr. Straub, that sometimes in this area, in line with what you have said, you do not realize how lucky you are or how much water you do have or how essential a product water is, has become to industry. In many areas it is the most essential raw material.

If you are in the water business nationally, as I am, you would be surprised -- or maybe you wouldn't -- because you may get the repercussions up here of how many people in other parts of the country are casting envious eyes at your water resource in the Columbia River and the Pacific

Northwest, and the plans to perhaps be able to get some of that for their own use; because in other areas of the country, it is very, very clear that the inhibiting ceiling on population and industrial growth is the lack of water and clean water. And I think it is surprising, again, if these people would ever come up here, with all the problems they have and the water they have, and hear us discuss low-flow augmentation at particular times of the year, or attempts to get the water cleaner, in the magnificent streams which you have flowing by in the Hudson -- the Columbia River. The Hudson is also magnificent. Going up there presents some real tougher problems than you have -- and in the Willamette River.

This is, indeed, a heritage that you have and something to build on. And I think in many, many parts of the country -- in the answer to their pollution -- "If we had as much water as you people have in the Pacific Northwest, we sure wouldn't have a pollution problem." And I don't know that they can imagine that you have, do have a pollution problem up here.

Mr. Spies, do you have anything further? I think, in order not to break into the statement of Oregon, we will recess for lunch now and try to reconvene at a quarter to 2:00.

We will stand recessed until quarter to 2:00.

Thank you very much.

(Whereupon at 11:40 o'clock, A.M., the conference recessed for lunch.)

(Whereupon at 1:40 o'clock, P.M. of this
day, Wednesday, September 8, 1965,
the conference reconvened.)

CHAIRMAN STEIN: May we reconvene?

Mr. Spies.

MR. SPIES: Ladies and gentlemen, we have another person in the audience whom I would like to introduce at this time. She happens to be a representative from Clackamas County in the Oregon Legislature. Mrs. Beulah Hand, would you stand up and take a bow, please? (Applause)

Now, to present the official statement for the Oregon State Sanitary Authority, I am pleased to call on Mr. Jack Weathersbee, Deputy State Sanitary Engineer.

MR. WEATHERSBEE: Mr. Chairman, conferees, ladies and gentlemen: My name is E. J. Weathersbee. I am Deputy State Sanitary Engineer employed by the Oregon State Board of Health. This will be a prepared statement and we will supply the reporter with a copy. The statement which I will present is for the Oregon State Sanitary Authority. It will cover three main points; namely, domestic or municipal sewage, the Willamette River, and industrial wastes.

First of all, with regard to domestic or municipal sewage, as stated in the report of the U. S. Public Health

Service, all municipalities located in Oregon, from which sewage effluents are discharged directly into the section of the lower Columbia River covered by this conference, have already complied with the minimum sewage treatment requirements adopted at the second session in September, 1959. These facilities include primary sedimentation, sludge digestion, and effluent chlorination. The location, design capacity and present connected load of each of these facilities are as follows:

The City of Clatskanie, located at River Mile 49, has a plant designed to serve 1400 people, and is presently serving 800.

The City of Rainier, located at River Mile 67, has a plant with a design population equivalent of 2,000, and is presently serving 1200.

The City of St. Helens, located at River Mile 86, has a design population equivalent of 8,000, and is presently serving 5,000.

The City of Portland, located at River Mile 105, has a plant design to 500,000 population, presently serving 370,000 population equivalent.

The Port of Portland, Airport plant, located at River Mile 110, is designed to serve 3,000, and is serving 3,000.

The City of Gresham, located at River Mile 118, is designed to serve 10,000 and is presently serving approximately 4500.

In addition to the above, similar sewage treatment facilities serve all privately-owned or semipublic sewage systems which discharge into this section of the Columbia River from the Oregon side.

With the exception of the chlorination facilities at the Portland municipal sewage treatment plant, all of these sewerage works were installed under the program requirements of the state of Oregon and not as a result of the Conference called in 1958 and 1959 by the Federal Government.

Except for the city of Arlington with a 1964 population of 963 all Oregon communities located adjacent to the Columbia River and upstream from the portion covered by this Conference also provide primary sewage treatment and effluent chlorination. Installation of such facilities for the city of Arlington has been delayed because of the construction of the John Day dam and reservoir by the Federal Government which necessitates relocation of a portion of the city.

Under surveillance of the State Sanitary Authority all of these existing public and semipublic sewage treatment works are currently being operated and maintained in a satisfactory manner.

Portland's sewage treatment plant, which was placed in operation in 1951, was designed to handle an average daily flow of 60 million gallons. At the present time daily flows to the plant average about 73 million gallons, and as a result it is hydraulically overloaded. In order to correct this deficiency and to provide additional capacity for the future, the city council has recently adopted a program for enlarging the plant sufficiently to handle an average flow of 100 million gallons per day. The estimated cost of this plant expansion is $1,450,000. Construction will be undertaken in the near future although no definite date has yet been set.

The report of the U. S. Public Health Service states that all cities and towns in both the states of Washington and Oregon now provide primary treatment and effluent chlorination and have complied with the minimum requirements adopted in 1959 by the Conference. The report states further that based on a survey conducted in September 1964, the bacterial quality of the river now closely approaches the standards adopted by the Conference.

In view of these facts it is the contention of the Oregon State Sanitary Authority that the conclusion presented on page 9 of the U. S. Public Health Service report is not correct as far as sewage discharges are concerned. It is the Authority's contention rather that present sewage discharges into the lower Columbia River from either state are not endangering the health or welfare of persons in

Oregon and Washington; and, therefore, are not subject to abatement under the provisions of the Federal Water Pollution Control Act.

There is one source of sewage pollution, however, which should be controlled by the Federal Government, and that is the pollution from oceangoing vessels, including those of the United States Navy. Raw sewage is discharged from such vessels while they travel the 100 or more river miles from the ocean to the Portland harbor, while in the harbor and while on their return to the ocean. On December 8, 1964, the Oregon State Sanitary Authority sent a resolution to the Secretary of the Department of Health, Education, and Welfare requesting his full support and influence in the early promotion of legislation and programs at the Federal level to control such sewage pollution.

Now, with regard to the Willamette River, the report of the U. S. Public Health Service admits that there is no evidence that the Willamette River has any significant detrimental effect on the quality of water of the Columbia River. It is the contention of the Oregon State Sanitary Authority that numerous studies have been made in the past 25 years, that such studies have not shown that the Willamette River flow contributes to the pollution problem in the lower Columbia River, that consequently and since the Willamette River is an intrastate stream it is not subject to Federal control; and, finally, that the state of Oregon has a very sound program under way and is making satisfactory progress in restoring and preserving the required degree of cleanliness in the public waters of the Willamette River.

In support of this contention the Authority is pleased to submit the following facts:

(1) Whereas prior to 1947 none of the cities or communities on the main Willamette River had any kind of sewage treatment, by 1957 all of them had primary treatment and chlorination and that by 1967 all of them will have secondary treatment -- that is, 85 per cent removable BOD and suspended solids plus chlorination.

(2) Whereas in 1939, when the Authority's program was first started, sewage from nearly 320,000 persons which represented 94.5% of the total sewered population of the basin, was being discharged into the river system without treatment, in 1965 the sewage from less than 8,000 persons, which represents about one per cent of the total sewered population, was being discharged without treatment, but by the end of 1967 essentially all sewage wastes will be receiving the equivalent of secondary treatment.

(3) Whereas prior to 1952 the wastes from the pulp and paper

mills in the basin, which constitute by far the major source of oxygen demand on the river, were being discharged without any treatment, they are now being treated or disposed of in such a manner that at the present time the individual mills are reducing the oxygen demand of their effluents from a low of 70 per cent to a high of 96.5 per cent, and by the end of 1967 all such mills will year-round be effecting removal of all settleable solids and during the period of critical stream flow will each be reducing individual waste loadings by from 85 to more than 99 per cent.

(4) Whereas prior to 1952 the dissolved oxygen in the lower Willamette River on occasion every summer dropped to zero, during the summer of 1965 in spite of almost record low stream flows and high water temperatures there has been only one day when the average low DO was less than 2.0 parts per million, and recently it has been between 3 and 4.5 parts per million.

(5) By 1968, at the latest, the main Willamette River will again be reasonably safe for water-based recreation and the quality of water throughout the basin, including that in the lower Portland harbor, will meet the Sanitary Authority's requirements for the protection and conservation of fish and other aquatic life.

Now, with regard to industrial wastes, the report of the U. S. Public Health Service refers to three industries located in the state of Oregon and makes recommendations for reduction of their waste loadings. Of these three industries only one actually discharges directly into the Columbia River.

The Kaiser Gypsum Company at St. Helens discharges the wastes from its 165 ton per day insulating board mill into Scappoose Bay about three-quarters of a mile from the confluence with Multnomah Channel and some 2-1/2 miles from the Columbia. In the past these wastes have caused excessive sludge deposits and during the late summer and fall months severe oxygen depletion in the intrastate waters of Scappoose Bay. For the purpose of abating this pollution and in response to instructions from the Oregon State Sanitary Authority, this mill, during the past three years has effected a 54 per cent reduction in the volume, a 60 per cent reduction in the suspended solids, and a 57 per cent reduction in the oxygen demand of its waste effluent discharged into Scappoose Bay. This has been accomplished by in-plant changes and improvements and increased re-use of process waters. Further reductions by such means will be made before the end of 1965.

Ultimate treatment requirements including primary sedimentation or equivalent for this mill are dictated by the water quality needs of Scappoose Slough rather than by those of the Lower Columbia River. It is doubtful that the wastes from this mill have ever contributed to the slime problem in the Lower Columbia River due to the fact that most of the solids contained in them have settled out in Scappoose Bay and their oxygen demand has been essentially satisfied before reaching the Columbia River.

The Boise-Cascade Corporation kraft pulp mill at St. Helens discharges its effluent into Multnomah Channel about three-quarters of a mile above the confluence with the Columbia River. These wastes in the past have caused a localized zone of sludge deposits, discoloration and oxygen depression in the adjacent waters of Multnomah Channel.

In response to instructions from the Oregon State Sanitary Authority, this mill, during the past year through in-plant changes and improvements, has reduced its solids losses from more than 20 tons per day in 1964 to less than 13 tons per day in 1965, a reduction of more than 35 per cent. The company is presently formulating plans to provide primary sedimentation for all waste flows which cannot be recycled and re-used.

It was not until Mr. Robert McHugh of the Oregon State Sanitary Authority made his studies in 1963 and 1964 that it was realized by us or the U. S. Public Health Service that wood fibers containing the effluents from pulp mills such as the one at St. Helens contributed to the slime problem in the Lower Columbia River. To eliminate this contribution and also to prevent sludge deposits in Oregon's public waters, the Boise-Cascade Corporation mill at St. Helens has agreed to provide primary treatment for removal of settleable solids from its waste effluents.

The one Oregon pulp mill from which wastes are discharged directly into the Columbia River is the Publishers' Paper Company mill at Oregon City. In order to reduce its pollution load on the Willamette River, this mill during the period of critical stream flow (June 1 to November 1) has, since 1952, barged its spent sulphite liquor to the Columbia River. Being unable to find a suitable site for a storage lagoon for impoundment of its concentrated wastes, the method of disposal used by three of the four other sulphite pulp mills in the Willamette Basin, the Oregon City mill was granted permission by the Washington Pollution Control Commission and the Oregon State Sanitary Authority to barge its concentrated wastes to the Columbia River as an interim solution to its waste disposal problem.

At the present time this mill is barging from 300,000 to 360,000 gallons of spent sulphite liquor per day. The oxygen demand of these wastes ranges from 60,000 to 70,000 pounds per day or only 8 to 9 per cent of the total pulp mill load discharged to the Columbia River.

For the past several months Publishers' Paper Company has been in the process of converting its Oregon City mill from the calcium base to the Magnefite process of sulphite pulp production. Three of the mill's six digesters have now been converted. It is expected that when the conversion has been completed it will be possible to concentrate the cooking liquors by evaporation and to burn them for recovery of heat and chemicals, similar to the sulfate and MGO processes. This would provide a satisfactory solution to the sulphite liquor problem and would eliminate the necessity of barging any wastes from Oregon City to the Columbia River.

Because the recovery of heat and chemicals from the Magnefite process waste effluents is still in a trial stage, a reasonable period of time will be required to complete the installation at this mill. It should be pointed out that in addition to being only a small fraction of the total pulp mill load on the Columbia River, the wastes from the Oregon City mill are discharged directly into the Columbia River only intermittently and only during the summer and early fall months when slime growth has not been a serious problem.

At the new kraft pulp mill which is being built by the Crown Zellerbach Corporation at Wauna, Oregon, all domestic sewage will be given secondary treatment including chlorination and all industrial wastes will receive primary treatment for removal of settleable solids before being discharged into the Columbia River.

At the new synthetic ammonia and urea plant being constructed at Columbia City by the Shell Chemical Company, no industrial wastes other than those from a water softening plant and cooling waters from the main processing plant will be discharged to the Columbia. The cooling water will amount to almost 12,000 gallons per minute and will be about 18° Fahrenheit warmer than the river water.

It is not expected that the effluents from either of these two new plants will have any serious detrimental effect on the quality of the downstream waters of the Columbia River.

In summary, all sewage effluents from the state of Oregon are already being treated in conformance with the action program of the 1959 conference. With the exception of discharges from ocean-going vessels, there is no sewage pollution in the Lower Columbia River at the present time from either Washington or Oregon that warrants abatement action under the provisions of the Federal Water Pollution Control Act.

Although numerous studies have been conducted of the Lower Columbia River since the 1958-1959 sessions of this Conference, no evidence has been found that the flow from the Willamette River has any significant detrimental effect on the water quality of the Lower Columbia River. The state of Oregon contends that it has an adequate program underway and is making acceptable progress in restoring and preserving a reasonable degree of purity in the public waters of the Willamette River.

Pursuant to instructions of the Oregon State Sanitary Authority and in order to abate the pollution of public waters of the state of Oregon, primary treatment, or equivalent, of industrial wastes, will soon be provided by the Kaiser Gypsum Company and Boise-Cascade Corporation mills at St. Helens.

Although the wastes discharged directly and intermittently to the Columbia River from the Oregon City mill of the Publishers Paper Company constitute only a small fraction of the total pollution load and contribute only slightly, if at all, to the slime problem in the Lower Columbia, the owners of this mill are presently converting their pulping process so that recovery of heat and chemicals will be possible and the barging of spent sulphite liquor to the Columbia can be eliminated.

The above facts are offered as ample evidence that the cities, industries and people of the state of Oregon are cooperating fully to abate and control pollution in the Lower Columbia River.

CHAIRMAN STEIN: Thank you, Mr. Weathersbee. Are there any comments or questions?

MR. HARRIS: I should like to ask a question.

CHAIRMAN STEIN: Yes.

MR. HARRIS: Jack, you mentioned something about chlorination of Portland's effluents, with an exception item. I wasn't sure I got that statement.

MR. WEATHERSBEE: This was the one factor of sewage treatment in Oregon that came about after the 1959 conference and somewhat as a result of the 1959 conference action program.

MR. HARRIS: Portland is chlorinating their effluent now?

MR. WEATHERSBEE: It has been since 1961 continuously.

MR. POSTON: Mr. Chairman, I have a question. I want to compliment Jack on his fine presentation and to learn of their action program, but judging from what I have been reading in the papers the last few months, it would seem that your timing was a little bit slow. Maybe that is what the problem is on the Willamette.

Would you care to comment on that?

MR. WEATHERSBEE: You want me to comment on that. I doubt if I need to. It depends on who is talking, Mr. Poston, whether they think the time was adequate or not.

MR. POSTON: Then you have made a point that there was no domestic pollution of the Columbia and what pollution there was came from transient vessels that were traveling. And it seems that you had a bill -- maybe it was passed -- in your last legislature to take care of the pollution from houseboats. Are any of those on the Columbia River?

MR. WEATHERSBEE: Yes. I think I made the statement that the only sewage pollution problem that warranted Federal control was the discharge of sewage from oceangoing vessels.

We did submit a bill to the last legislature and it was passed. That is designed to control the discharges of wastes from houseboats, and a number of these are located on the Columbia River. A deadline of July, I believe July of 1967, has been established for correction of these discharges.

MR. POSTON: Well, then, going back further into your discussion of bacteriological quality, the River then, in your opinion, is safe for water-contact sports -- swimming and so forth?

MR. WEATHERSBEE: I think that the Columbia River, with the possible exception of limited areas immediately downstream from sewage plant discharges, is in excellent condition bacterially, and I think it is a very clean river for the size of it, and a very good recreational river, absolutely.

MR. POSTON: Thank you very much.

CHAIRMAN STEIN: I don't know what you mean by "size."

MR. WEATHERSBEE: Mr. Stein, I was somewhat comparing it with the Potomac. I was surprised to hear yesterday on TV that the Columbia River wasn't as clean as the Potomac.

CHAIRMAN STEIN: I didn't hear that on TV. I am surprised you heard it, too. Let me tell you what I said. This might help you on the Columbia. I have said on the Potomac that if your program was as far along as the program -- in the metropolitan Washington area -- on the Potomac, we would be very happy. On the Potomac, we have complete secondary treatment of all municipal wastes and chlorination. Perhaps when you have that, you might be up to that point.

We also have spent about a hundred million dollars on intercepting stormwater overflows, and the wastes of that are being handled so they will not pollute the River.

Now, you may be talking in terms of jurisdictional situations here on the Willammette River, and this was maybe intrastate, but when you have had a situation where you have your stormwater problem under control and you feel that you have secondary treatment and don't have to put all that chlorine in, then maybe you will be as far along as the Potomac.

I would like to ask you another question, though: You point out in your statement, particularly about

Publishers' Paper -- and I think I should point out to you, because this is a conference and we just want to have this as a discussion -- I did consult on this with Mr. Hayse Black, our industrial waste consultant.

You indicated that the recovery of heat and chemicals, heating and burning of the Magnefite process waste effluents is still in the trial stage. On what basis do you say that is still in the trial stage?

MR. WEATHERSBEE: That is my understanding, that it is. I can't -- I think that the Company can comment on this in more detail -- in fact, I'm sure they can; but they have -- and I can't recall the year -- but a number of years ago, put up a sizable amount of money so that they could contribute and participate in this particular process. And it's my understanding that this particular process has not been utilized extensively on a full-scale basis. So this is why I made the statement.

CHAIRMAN STEIN: I think we would like to define the issue on this, particularly if the Company is going to come up. And I wonder -- by the way, I picked this out because I had some other information, but, obviously, I am not a technical expert on this. I wonder if, to define the issue and indicate what the varied views are before the Company comes up, we can ask Mr. Black, who I think all of you know, to make a brief statement on this, with you having the last word to indicate what the issue is on this evaporation and burning.

Mr. Black, may we hear from you on this, because I think this is going to be -- why don't you get up to the mike? I think this will be ----

MR. WEATHERSBEE: Mr. Stein, is this an appropriate time for this?

CHAIRMAN STEIN: Yes.

MR. WEATHERSBEE: We are carrying on Oregon's time.

CHAIRMAN STEIN: You will have all the time in the world. I think we want to have this in the record. Do you object to his doing this?

MR. WEATHERSBEE: Well, if it's up to me, I do, at this time. (Laughter)

CHAIRMAN STEIN: Well, ----

MR. WEATHERSBEE: We'd like to carry out Oregon's presentation.

CHAIRMAN STEIN: I thought you had completed.

MR. WEATHERSBEE: Is our time over?

CHAIRMAN STEIN: No, your time is not over; but all I can say, sir, is if we have to define an issue, and we want to call our technical expert up and you're not prepared to have him come up and define an issue on a statement that you have made, that this is still in the trial stage, I think your attitude and the facts of the situation speak for themselves.

Mr. Weathersbee, we will be glad to withhold Mr. Hayse Black until a later time if you feel that is appropriate.

MR. WEATHERSBEE: I think that would be very courteous of you until the Publishers' Paper Company has had an opportunity to make their statement.

CHAIRMAN STEIN: By the way, I am not sure that Publishers' will feel that way. They may want to hear what Mr. Black has to say to give them the last word. I think we tried to be courteous to present the views ahead of time, to give Publishers' Paper Company the last word. We don't want to give the Government the opportunity to stand back in the position of rebuttal. Our position has always been to place the Government's position first and to allow industry or state agencies to make the rebuttal. But if Oregon wishes to handle this the other way, we will be glad to comply.

MR. WEATHERSBEE: You're the chairman; you just asked for my opinion. I gave it to you.

CHAIRMAN STEIN: How about the Oregon conferee?

MR. SPIES: Well, I don't think this is any point to be arguing about. I will have to overrule my deputy; and you want Mr. Hayse Black to speak. If he has any information that helps solve this problem, we are welcome to have it.

CHAIRMAN STEIN: Mr. Black, will you come forward and make a statement?

MR. BLACK: Mr. Chairman, conferees, ladies and gentlemen: In the interest of protecting the streams in the Pacific Northwest and elsewhere, we have been, for a period of years, quite interested in the soluble base cook for producing pulp.

The MGO process that was introduced in this area several years ago, was one that had a great deal of promise, and the MGO process has interested others in other parts of the world. It has some advantages that are well known to the people in the pulp and paper industry.

We were interested enough in this to go to the Scandinavian countries three years ago, and spent some time visiting mills in Sweden, Finland, and Norway; and, if you will remember, two of those men came to Seattle in the fall of 1963 and appeared on the panel for discussion of some of these problems.

In fact, Sweden was interested enough to send two of their scientists to the United States awhile back for the expressed purpose of looking into this Magnefite modified MGO process. They're using it in Sweden and I don't believe experimentally.

We have the impression that some pulp mills in the United States are using this Magnefite process with success, and I believe that the pulp and paper people can name them.

The issue seems to be as to whether or not the Magnefite process is to be considered experimental. We were not of that opinion. We thought that it was pretty well proven. In fact, it seems to have some advantages over the conventional MGO process.

We are optimistic about it. We thought you might be also.

CHAIRMAN STEIN: Thank you, Mr. Black.

Are there any comments or questions?

MR. SPIES: No, I don't have any questions. I think our point was -- the process itself is not experimental, but there seems to be some question as to the feasibility of recovery of the heat chemicals.

MR. BLACK: Of course, recovery is the principal issue. We are operating at a higher pH; you should have less corrosion. It would seem to be a process that would even, possibly, be superior to the conventional MGO process. We do not understand these difficulties and neither do you bring them out in your report. Perhaps the pulp and paper people will touch upon that.

CHAIRMAN STEIN: I think, if I understand this -- and I ask you again -- I'm just trying to define the issue -- according to our industrial waste expert -- and this is not a question of qualification, but I think those in the field know Mr. Black; he is our senior industrial waste expert -- as I understand you -- and you correct me if I am wrong -- the Magnefite process will result, with evaporation and burning, in a sharp reduction, if not elimination, of discharges of waste to the streams.

You do not believe that this is in a trial period, but you believe this is a proven process which will be effective if constructed and operated correctly. Is this correct?

MR. BLACK: Yes, sir.

CHAIRMAN STEIN: And I think if there are any different opinions and there are any facts to carry this out, I think the conferees would be anxious to hear this. For my mind, I think this is a significant issue. Again, we are dealing with this, and I think the paper companies should recognize this.

The judgment on this would seem to me to be very appropriate for the conferees' determination, and I will bring this up to them. If we should determine that Publishers' Paper or someone else should go to the sponsors, it would seem to be appropriate in dealing with the time schedule.

I think this is a very critical point, and this is why I am trying to bring this out. I have no judgment on this now. I think the conferees will have to make the judgment, but I think we have heard from Mr. Black and we will be glad to hear from the industry or any other comments that the conferees might have on this.

If not, thank you very much, Mr. Black.

Mr. Spies, would you continue with the presentation?

MR. SPIES: Next, I would like to call on a representative of the Boise Cascade Corporation mill at St. Helens.

MR. McDEVITT: Mr. Chairman, ladies and gentlemen, conferees: I am Charles McDevitt, Boise Cascade Corporation.

With the consent of the chairman, the statement of Boise Cascade will cover its mills both in Washington and Oregon in one statement, in that we have been invited by both state agencies, and we feel we can cover it at one sitting rather than come here and take your time twice.

If there is no objection, I will proceed on that basis, Mr. Chairman.

CHAIRMAN STEIN: None at all. Would you proceed on that basis, then?

MR. McDEVITT: Thank you, sir.

Boise Cascade Corporation is new to this conference and to this type of conference with the Federal Government, having acquired its mills on the Lower Columbia River in 1962 and 1964. After studying the past history of the use of the Lower Columbia River waters and the quality conditions existing at that time in this portion of the river, we undertook further water studies of this area on our own volition. These studies were to provide the basis for a continued program for the maintenance of water quality. consistent with the multiple use of the water from the Lower Columbia and the interests of the general public. A review of the steps we have taken over the past two years since we first acquired ownership as a result of our studies is as follows:

1. When Boise Cascade Corporation acquired the Vancouver, Washington mill, the fiber losses were reviewed and the usable fibers were found to have been reclaimed or additional steps were taken to retain them. As a result of our studies of the rejected fibers, we installed radiclones, side hill screens, precleaners, and a reject press to collect these fibers and prepare them for subsequent burning, thereby substantially reducing the fiber load on the Columbia River.

2. Concurrently with our studies on this project, Boise Cascade made extensive dye studies, and based on these studies, in connection with the Washington Pollution Control Commission, placed an extended outfall line from its Vancouver mill to the center current of the Lower Columbia River in an effort to eliminate the possibility of Sphaerotilus growth along the banks of that river. Although we admit a thorough evaluation of this project will require monitoring over more than one year, the decline in

Sphaerotilus growth in the area downriver from our mill outlet in the spring and summer of this year is noteworthy. The extended submerged outfall consists of a 36-inch pipe extended 580 feet into the deep water of the river channel.

3. In June, 1965, Boise Cascade commenced engineering studies of sedimentation of fiber-bearing effluents and voluntarily agreed with the Washington State Pollution Control Commission to invest in necessary equipment and have in operation mechanical means for providing sedimentation during 1967 at the Vancouver mill.

4. It should be acknowledged that since Boise Cascade acquired the Vancouver mill in 1962, the production of this mill has increased 30 per cent from 150 tons per day to 200 tons per day. At the same time, the daily water consumption of the mill has been reduced 20 per cent, while, concurrently, steps have been taken to reduce solids.

5. Boise Cascade is now conducting negotiations with the Washington State Pollution Control Commission for a permit for the operation of its Vancouver pulp and paper mill providing for a program to substantially reduce BOD discharge into the Lower Columbia River receiving waters.

6. Although Boise Cascade only acquired the St. Helens mill in 1964, engineering work is under way to provide sedimentation for that facility. The Company has agreed with the Oregon Sanitary Authority to install sedimentation

equipment during the first half of 1967. It should be noted that the settleable solids discharged to the Columbia River by the St. Helens mill has been reduced 28 per cent since Boise Cascade acquired this facility a year ago. This fact is substantiated by Illustration No. 6 of Mr. Ferris' report this morning.

We feel that these steps, together with the further steps being taken with and in conjunction with the two state agencies in the short period of time that we have been involved in these receiving waters, demonstrate the voluntary action program that has been undertaken, and further project the additional steps that, in connection with these two state agencies, can and will be taken in the future.

I thank you, Mr. Chairman.

CHAIRMAN STEIN: Thank you, Mr. McDevitt.

Are there any comments or questions?

MR. POSTON: You are contemplating in what part of 1967 your sedimentation facilities at Vancouver? What is your planning on that?

MR. McDEVITT: We have assured the agency that they will be in operation in 1967. This depends in part upon the completion of all of the engineering itself. To give you a month, date to date, I could not, sir. It will be as soon in 1967 as we can, together with the operation of the mill, concluded.

MR. POSTON: Thank you very much.

CHAIRMAN STEIN: Are there any comments or questions?

If not, thank you very much, Mr. McDevitt.

Mr. Spies.

MR. SPIES: Next I will call on Mr. John Cassidy, Kaiser Gypsum Company, St. Helens.

MR. CASSIDY: Mr. Chairman, conferees, and ladies and gentlemen:

I am John Cassidy, the plant manager of the Kaiser Gypsum plant in St. Helens.

I would like to read from the contents of a letter of August 31 to Mr. Spies.

"The following major changes have been made in the plant since 1963:

1. All waste water is now combined into one outlet; in 1963 there were three.
2. The installation of a new digester system has eliminated the major cause of fiber loss.
3. A new dust recovery system for the Remanufacturing Department now recovers all dust and fibers for reuse, the old system was approximately 75% efficient.
4. In the board manufacturing department, two collecting tanks with pumps have been installed for reuse of water. These are on the suction

belts and rolls and on the vacuum pumps.

5. A sump pit was built in early 1965 for collection of all waste discharge.
6. A Save-All was installed in early 1965. All discharge from the plant goes through this Save-All. Due to improper showers this unit is only about 25% efficient. The manufacturers have recommended a different type shower, delayed delivery is now scheduled for September 1965. This unit was ordered in May of this year.
7. Prior to June of 1965 all production was treated with approximately 0.3% Arsenic Trioxide for mold and fungus control. At present approximately 5% of the production is treated.

The above changes have resulted in the following improvements:"

There are four figures that I will quote. They are prior to 1963, which are quoted from a March, 1963 report of the Oregon State Sanitary Authority on conditions in Scappoose Bay -- 1963, 1964, and 1965 year to date.

The total flow of million gallons a day has been reduced from prior to 1963 from 2.6 through '63 of 1.8, '64 of 1.7 to a year to date of 1.2.

Our solids have been reduced from prior to 1963 of eight tons per day to 1965 year to date of 3.2; and our

BOD in pounds per day has been reduced from 18,000 in prior to 1963 to 7,805 for year to date, 1965.

"With the installation of the new shower for the Save-All, we expect to have approximately three-quarters of a million gallons of water that is now wasted for reuse in the operation. The total effects on the solids and BOD loadings will have to be evaluated at that time, but we expect a substantial reduction.

The 70% reduction in solids, as shown on page 6 of the August 1, 1965, report, shows a total of 2300 pounds a day with primary treatment. Based on past performance, expected improvements with existing equipment, plus additional inplant controls, we feel that we will be able to close up our system and reduce the discharge of solids by 70% without further treatment.

In addition to the mechanical and operational changes that we have made, a program of employee education in improvements and controls has been started. This is through our monthly Newsletter that is mailed to all employees."

CHAIRMAN STEIN: Any questions or comments?

Let me see if I understand this. I don't think there really is any substantial difference between your program and the Federal Report and Recommendations, as I see it.

Certainly the reduction in suspended solids is about the same -- 70 per cent.

Now, the figure you have for your BOD removal is 7,805 a day. The recommendation of the Federal Report is 5970, but you indicate that with the new shower there should be a substantial reduction. We probably are not very far apart.

MR. CASSIDY: We expect to make that figure, yes.

CHAIRMAN STEIN: Yes. Is this everyone's understanding here? As I understand it, with Kaiser Gypsum, in your report there really is no essential difference; is that correct?

MR. POSTON: Not exactly.

CHAIRMAN STEIN: Well, let's hear it.

MR. POSTON: We had expected to -- we advocate the installation of sedimentation primary treatment. He's effecting this with process changes. We gave 70 per cent, and perhaps a low figure. Perhaps with his waste it will be -- this is with another type of installation that we advocated, 70 per cent.

A VOICE: Microphone, please.

MR. POSTON: What is proposed here is by changing a process to achieve the same thing that we had advocated being achieved with treatment. We feel that the 70 per cent that would conservatively be achieved with the treatment, primary treatment that we recommend, would probably be more effective than could be achieved with in-plant process changes.

I just wanted to make that point clear. I will agree with the chairman that we are very close together on what the final results are, but I want to point out that it was being achieved by two different methods.

CHAIRMAN STEIN: Let me ask you something: Why does it make any difference to a federal or state agency on how the plant achieves this as long as they achieve the result?

MR. POSTON: These in-plant changes are something that we have listened to for many years, and we were promised they were going to do it, and it didn't produce a result; so we felt that to be on the safe side, to accomplish our mission, we would have to advocate primary treatment, which we would define as sedimentation in the removal of a minimum of 70 per cent of the suspended solids.

CHAIRMAN STEIN: Are there any further comments or questions? Do you want to comment on that?

MR. CASSIDY: Well, is my program acceptable?

CHAIRMAN STEIN: Again, you will have to leave this to the conferees. I tried to raise it. I am trying to define the issue.

As far as I can see -- and I raise this; the Federal Report asks for certain results -- as far as I can see, there is no difference or very little difference, if any, in what you are talking about results and what is asked for in the Federal Report.

We will have to discuss the issue raised by Mr. Poston with the conferees. But I would say what we are dealing with, if there is any difference at all, is with a real technical difference here. I think we are very close together.

Thank you very much.

MR. CASSIDY: Thank you very much.

CHAIRMAN STEIN: Mr. Spies.

MR. SPIES: Mr.Frank McColloch representing Publishers' Paper Company.

MR. McCOLLOCH: My name is Frank C. McColloch. I am a lawyer with offices in Portland, Oregon.

I am appearing for Publishers' Paper Company today, pinch-hitting for Mr. S. J. Robinson, as president, who is unable to attend.

My law firm has been general counsel for Publishers' Paper Company continuously since its organization in 1948 or '49. In the interim, it has been my privilege to play a substantial part in the writing and subsequent administration of many of the later water laws of Oregon, including even a minor part in the writing and subsequent enactment of the Oregon Water Pollution Statute which was approved by our voters in 1938, and which, since then, has been so ably administered by our Oregon State Sanitary Authority.

Necessarily, because of my own professional limitations, I am going to be confined pretty much to the statement that has been prepared by Mr. Robinson over his signature, and which I will now, with some small paraphrasing, proceed to read in the record.

It contains a statement concerning the Magnefite process which is over Mr. Robinson's signature concerning which I am not in position to expand.

In two respects, the bare text of the report of August, 1965, which is before this conference, impliedly ascribes to Publishers' Paper Company a greater contribution to the pollution of the lower Columbia than is literally true.

We are the bargers to whom reference has been made, and we are in the rather unenviable position of being a paper mill on two rivers embroiled in two different pollution problems, and we would like to trade with anybody, even steven, on any basis available.

We refer, particularly, to Table I which ascribes to us 60,000 pounds of discharge per five day BOD day of the total of substantially, in round numbers, 778,300 pounds set out in the Table. And elsehwere the Report also uses the bald statement concerning the discharge of effluent by the mills in general that "there is no recovery of base materials from the concentrated waste liquors."

In considering the Table No. I figures, it should be noted that our barging program is seasonal, not perennial, occurring only between July 1 and October 1, and therefore does not occur during the critical April-May season of "severe slime growth" which is mentioned on page 37 of the Report. Even then it is not continuous throughout the day. Never more than six barge loads are discharged in any 24 hour period, and seldom do any two of any such discharges occur at intervals of less than five hours on any one day. It is also worthy of note that our share of such total discharge is less than eight per cent of the whole.

Unlike the other mills listed on Table I, our operation is located on the Willamette at Oregon City and the barging program is a part of a water quality improvement program particularly aimed at BOD control instituted by formal order of the Oregon State Sanitary Authority in 1950. No ponding sites were available, which compelled us after three years of experimentation with other methods of disposal, to adopt the far more expensive operation of barging. Our total capital investment in docks, barges and other capital assets, plus operating expenses for the period since the first conference here in 1958 only, exceeds $750,000; and our 1965 operation and maintenance costs will add another $128,000. We would gladly go to ponding if it were feasible in lieu of this expensive operation.

The barge operation was officially authorized by the

Sanitary Authority in 1953 with the acquiescence of the appropriate agencies of the State of Washington, and throughout the 13 years of its existence has been closely supervised and policed by our Oregon Sanitary Authority. The regulations laid down by the Authority require that the discharge be made in the main channel of the Columbia on the Oregon side of the Oregon-Washington boundary line two miles below the mouth of the Willamette. The discharge valves must be adjusted so as to emit the liquor slowly over a period of at least one hour, while in the meantime the tug keeps the barge in constant motion within the main channel where the current normally is the swiftest.

In the intervening 13 years since this operation was authorized, all our water quality planning and expenditures have been made upon the assumption that the barging operation would be permitted to continue indefinitely, or at least would not be terminated without reasonable notice and ample time to permit the completion of existing improvement programs before turning to devising means and methods of a substitute for the barging operation. Since 1959 only, for example, our direct pollution control costs, in addition to the above-mentioned barging costs, have totaled better than $80,000, while our investment in operating plant and equipment with built-in stream improvement capabilities has exceeded $2,450,000 with an additional outlay for 1965 of better than $1,100,000 in groundwood refiner additions and a sulphite screening system. Within these figures just cited, the expenditures directly related to "recovery of base material from the concentrated waste liquor" -- referring again, to the text of the Report -- since 1958 only, totals more than $126,000, including such items as a program of removal and burning of sulphite knots, installation of a white water and saveall systems on paper machines, a sulphite screening refiner and substantial improvements in the sulphite reject system. These improvements since 1958 are typical of many others which were systematically made as plant improvements occurring between 1950 and 1959. Additionally, every load of barge liquor is separately screened at the time of loading, and the quoted statement in the Report is, therefore, not literally applicable to our company's operations.

As previously stated, all our planning and expenditures concerning improvement of water quality have been made upon the assumption that at very least we would be given an adequate period of grace to permit appropriate readjustments in the event it was determined to cancel our barging operation permit. The grace periods specified at page 10 of the Report are completely inadequate for the reasons heretofore and some which will hereafter be stated.

The recommendations in the report of August, 1965, are substantially different from those made in a report which was circulated bearing the date of April, 1965, and, unfortunately for us, our first view of the August Report occurred on or about August 27, 1965, only a few days after we had committed ourselves to the Oregon Sanitary Authority to an expenditure of not less than $1,000,000 over the next two calendar years on plant improvements designed to eliminate solids from the effluent discharge at Oregon City. Enforced termination of the barging operations will completely unjoint and dismember the above-mentioned program unless a grace period of at least five years is allowed.

This settleable solids program is being engineered for us by an internationally noted firm of consulting engineers.

It comprises four stages. Stage No. 1 is already under construction, will be finished this year. Subsequent stages are now undergoing detailed engineering. No. 2, a gravity collection system, will cost us $293,000. No. 3, a pumping station pressure system and clarifier, estimated to cost $446,000, and the last and final stage includes a solids dewatering and incinerating installation estimated to cost $250,000.

Another problem is this which has been indirectly referred to as the Magnefite process problem.

Competitive conditions in the field of newsprint production are forcing all sulphite mills producing newsprint, as we do, to either convert to kraft or to find other means for improving the strength of their chemical pulp. Situated as we are abutting upon Oregon City and within easy smelling distance of Portland's southerly bedroom area and with southerly prevailing winds, a conversion to kraft would merely substitute an aggravated air pollution problem for the existing water problem. In early 1963, we instituted a five-year research and pilot plant program to test the feasibility of converting to the Magnefite process, and as at December 31, 1965, will have expended $700,000 on this program with a budget of $250,000 for the years '66 and '67. Now, the research and experimentation is to find out if this process will meet our competitive condition. At present, there is no feasible recovery system available for our comparatively small daily output, but research is continuing in that field as well, and we will, if the shift to Magnefite is demonstrated to be feasible from the competitive point of view and the product point of view, supply ourselves with the best recovery system then available. In the meantime, we submit that we should not be required to spend the necessary capital on a sulphite recovery system which might well have to be discarded almost as soon as it is installed.

Now, in summary, after examining the April, 1965, draft of Report, and noting that there was no indication of any present intention to interfere with our barging and that a construction program aimed at all fibers and other suspended solids was recommended, which was completely consistent with our own program and with the Oregon Sanitary Authority, we proceeded to commit ourselves to the Oregon Authority for a million-dollar expenditure for over the next two calendar years designed to substantially decrease the settleable solids discharged by us at Oregon City.

And, gentlemen of the conference, remember, please, that we are an important factor in the pollution problem in the Willamette, and we are a pygmy in the pollution problem in the Columbia, at best. It is the balancing of the equities and the balancing of the duties, shall we say, to the public, is in favor of us concentrating where we are the largest factor in this problem.

We pledged ourselves to this program only a few days before August 27, 1965, which was the first date that we had any notice or had any knowledge of this wholly different Report of August, 1965, with its expanded recommendations, including elimination of our barging.

We cannot comply with both programs within the time allotted; and, in fact, we cannot even make a start on the Federal program within that time, which compels us either to renege on our commitments to the State of Oregon or resist the Federal recommendations as they are written.

Topographical and geological conditions and terrain at our plant site and the other circumstances hereinbefore detailed, combine to create joint problems of "physical feasibility" and "economic feasibility" which are mentioned in Section 466(g), U. S. Code section of the Water Pollution Control Act. And the facts amply support the suggestion that the effect of our discharge of effluent, taken alone, upon the legitimate uses of the waters of the Columbia, would not be of sufficient significance to warrant the exercise of Federal jurisdiction within the meaning of Section 466(g) (c) (1) of the Act.

We, therefore, earnestly urge that as to Publishers' Paper, the effective date of the recommendations be given indefinite postponement awaiting further study and scheduling when the construction and research programs to which our company is formally committed have been completed.

Respectfully submitted, Publishers' Paper Company, by S. J. Robinson, President.

CHAIRMAN STEIN: Thank you, Mr. McColloch, for an excellent statement.

Are there any comments or questions? I have a couple of questions. They're not going to be technical because I am also a lawyer, Mr. McColloch.

One, what is your proposal? I am not sure I understand that. In one part of it you ask for a five-year grace period, as I heard you, and the last paragraph you ask for an indefinite postponement.

MR. McCOLLOCH: Well, we have got to have this problem: We had to prepare this statement rather rapidly. We first heard of it August 27, this complete change. We have had about six or seven working days to consult about this thing. That question of the postponement, I will submit, is worthy of discussion and should be discussed. This is our estimate as to what it is. I think it's something that could be talked about around a table in Mr. Spies' office or in Mr. Poston's office, and when we all have more time to really know where we are. I use the word "indefinite" in summary rather than five years. That was used -- I suggested that to Mr. Robinson deliberately, because there is a space for talk there -- discussion.

CHAIRMAN STEIN: Well, the point is, if you are not sure you can do anything, there is no real firm process in sight, perhaps five years may not be the time.

MR. McCOLLOCH: Well, if the Magnefite process doesn't go ----

CHAIRMAN STEIN: Yes.

MR. McCOLLOCH: -- we may have to go for kraft, and I don't know whether the Oregon State -- no one knows -- we may not be making newsprint paper.

CHAIRMAN STEIN: Well, I am talking in terms of your proposal. Your proposal may be for an indefinite postponement really, isn't it?

MR. McCOLLOCH: Well, I think that is probably an accurate statement, and with a review, sir, when we know more about what the future of our mill is.

CHAIRMAN STEIN: Well, now, I think that clarifies the position that you have.

Now, there is another point, and this, to my mind, sir, is a legal point. I am not disputing the notion about if you were the only discharger of liquid pulp and paper waste into the Columbia River, that there would be a significant interstate pollution problem by yourself, which you point out in the next to the last paragraph, you say, "The facts amply support the suggestion that the effect of our discharge of effluent, taken alone, upon the legitimate uses of the waters of the Columbia would not be of sufficient significance to warrant the exercise of Federal jurisdiction within the meaning of Section 466(g) and so forth of the Act."

I am not disputing this point at all; but I do think, sir, that the cases in pollution are almost uniform on the proposition that an aggregate number of polluters are jointly and severally liable even though any individual one, if discharging alone, would not create the problem.

Now, if the judgment of the Federal Government is correct -- and we have been in several of these conferences; I don't think this is disputed by the states' investigators -- that in the aggregate, you were creating a pollution problem, even though any mill not discharging alone would create that problem, you jointly and severally are liable, because the same argument may very well be made by several of the small mills discharging into the Columbia River. I think we heard from two mills here that implied the same kind of argument.

MR. McCOLLOCH: I am not -- I am too wise to stand here and debate with you on that. That was thrown in there, suggested by me, because it is in the Act.

I have in mind, sir, that this is -- we are not adverse parties -- here is a basis; I'm thinking of the equities, sir; this is a part of it. It emphasizes I thought with our other point, that we are really a pygmy in the Columbia.

Now, we are squatters in the Columbia; we were there before your Federal Act. We have some equities. We were there. The old West recognized the squatters' rights. Those are equities.

There is the philosophy of the grandfather rights in the more modern regulatory statutes. Upon that basis, sir, it's our point that we are entitled to some real consideration.

CHAIRMAN STEIN: I thoroughly agree with you, and I give this to the conferees, if they have any comment while you are here. I do not think, Mr. McColloch, that the Federal program or the Federal Conference should come up with any recommendations which would be counter in any way to the Oregon State program, and I think that ----

MR. McCOLLOCH: Thank you.

CHAIRMAN STEIN: -- I think the equities of the case are such -- and we recognize your position on the river, and, obviously, we recognize the tightness of your site, because this is not an unusual situation.

MR. McCOLLOCH: You have to see it to believe it.

CHAIRMAN STEIN: You know, we deal in pollution control throughout the country, sir, and this is not an unusual situation. People will go down on the riverbed; you may not be too bad here.

MR. McCOLLOCH: Hide under a cliff, though, or ----

CHAIRMAN STEIN: You should see some people in the Rocky Mountain States where they don't build a plant on the butte, but they get down into the valley, and there really is no place to go, because if they were going anywhere they'd have to get on top of the butte and start pumping. This is not an unusual situation, but I would suggest that any solution or recommendation that comes up should take into account the requirements of the Oregon program and the Federal program, and I think that these programs very well should dovetail.

MR. McCOLLOCH: That is excellent, and if it comes back upon the basis where these other problems as to the extension of time, upon the basis where we can sit down with the state of Washington and with the state of Oregon, talk about that situation and discuss it, I am sure there would be no problem.

CHAIRMAN STEIN: Sir, again I don't want to mislead you in any event; but I think you know this case first started in '58. Then we had another conference in '59. Here it is many years later, and I don't know if the time at present is to think about indefinite postponements.

MR. McCOLLOCH: I will remind you that eleven days ago was the first criticism we had heard about our barging. So since 1959, we have spent a lot of money and done a lot of things at Oregon City upon the assumption that barging at least was ----

CHAIRMAN STEIN: Sir, with all due respect, ----

MR. McCOLLOCH: Yes, sir.

CHAIRMAN STEIN: -- and you have indicated you have worked with the Publishers' Paper since its beginning -- it seems to me that whatever we have done about the barging, I have heard criticism of the barging operation from the first day I heard about this problem.

MR. McCOLLOCH: I attended the early conference. I know of nothing in the reports.

CHAIRMAN STEIN: This really -- by the way, I am not drawing any conclusions; we didn't draw any conclusions on that, but I am saying this again comes to the notion that we have in several parts of the country. You always get the problem where, if you have water in a watershed and you take it over to another watershed to use it to drink, you are going to have problems by the watershed -- of the watershed you take it out. And you people well know how sensitive you people in the Columbia River are to encroachments from other dryer areas that may want to take your water out. And in the same sense, we have proposals from time to time and processes from time to time where waste, created in one place, is piped or barged, taken to another place and dumped, and that always seems to me to create a problem and create criticism.

MR. McCOLLOCH: We know now somebody doesn't like it.

CHAIRMAN STEIN: Are there any comments or questions? If not, thank you very much, Mr. McColloch.

MR. McCOLLOCH: Thank you.

MR. SPIES: Next, I would like to call on Dr. Herman Amberg, who, I believe, will speak regarding the new mill under construction at Wauna, Oregon, by Crown Zellerbach Corporation.

DR. AMBERG: Mr. Chairman and Conferees: I am Dr. Herman R. Amberg. I live in Camas, Washington where I am employed in the Central Research Division of Crown Zellerbach Corporation as Manager of Chemical and Biological Research.

Crown Zellerbach Corporation has just completed the first phase of a major construction project at Wauna, Oregon, involving an overall capital expenditure in excess of $90 million. The first unit, a tissue machine started last month. The second phase of the project includes a kraft pulp mill having an annual capacity of 250,000 tons and a bleach plant of 225,000 ton per year capacity. The facilities will include an all-refiner groundwood mill with an annual capacity of 105,000 tons as well as two additional papermachines. Wood for the Wauna mill will be supplied from company timberlands and through outside wood and chip purchases. The mill is designed to make maximum use of residual materials which have not extensively been used for pulp up to the present time. The entire complex will be completed and in operation by 1967.

Mr.Spies, Secretary and Chief Engineer of the Oregon State Sanitary Authority, invited me to attend this conference to outline the water quality control program to be used upon completion of the pulp and paper mill at Wauna. I would like to briefly describe the system which will be used to treat and dispose of the sanitary sewage and process effluents from this mill.

Some 250,000 tons of kraft pulp will be produced per year using the most modern pulping and recovery equipment. Because of chemical recovery, losses of organic or BOD containing material will be at a minimum. Paper machines will be equipped with savealls which will permit the recovery of reusable fiber for return to the papermill. The effluents from the kraft pulp mill, groundwood mill, bleach plant, and paper machines will be collected, combined, and pumped to a primary treatment plant for removal of settleable solids. The treated effluent will be discharged into the Columbia River by means of a deepwater outfall. Adequate facilities for the disposal of recovered solids or sludge will also be provided.

Sanitary sewage will be collected in a separate sewerage system and pumped to a sewage treatment plant. The treated sewage will be discharged through a separate pipe line into the Columbia River.

We have worked closely with the Oregon State Sanitary Authority on the design of the treatment system for the initial phase of our operation, the tissue machine. Upon completion and start-up of the pulp mills, bleach plant, and two additional papermachines, all of the process effluents as well as the sanitary sewage will receive treatment to meet the requirements of the Oregon State Sanitary Authority. In addition, the treatment facilities proposed will comply with the recommendations in the August 1965 report of the U. S. Public Health Service.

Thank you.

CHAIRMAN STEIN: Are there any further comments or questions?

Dr. Amberg, I notice -- I always like that phrase "sanitary sewage." Are you going to give that secondary treatment?

DR. AMBERG: Yes, we are going to give that treatment.

CHAIRMAN STEIN: Secondary?

DR. AMBERG: Secondary treatment.

CHAIRMAN STEIN: But your pulp and paper waste will be given primary treatment?

DR. AMBERG: Primary treatment.

CHAIRMAN STEIN: This is not getting quite as much treatment as that waste at the new Kimberly-Clark mill in Andersonville, California.

DR. AMBERG: I don't think it's necessary, sir.

CHAIRMAN STEIN: This is not an intrastate situation, is it?

DR. AMBERG: We will be discharging into the Columbia River.

CHAIRMAN STEIN: Into the Columbia.

Are there any further comments or questions? If not, thank you very much, Doctor.

Mr. Spies.

MR. SPIES: Are there any other representatives of the pulp and paper industry here from the state of Oregon who would like to be heard at this conference?

If not, I will at this time call upon a representative of one of the other state agencies, Mr. Jim Haas, who represents the Oregon State Fish Commission.

MR. HAAS: Mr. Chairman, conferees, ladies and gentlemen:

My name is James B. Haas. I am Water Resources Analyst for the Fish Commission of Oregon and am representing that agency.

The Fish Commission of Oregon is charged with the duties of protection, preservation, propagation, cultivation, development, and promotion of the anadromous, food, and shell fish resources of the state. Our agency has important regulatory responsibilities as well as conducting research.

The Columbia River system is one of the major anadromous salmonid production areas on the Pacific Coast. Important species inhabiting the system include chinook, coho, sockeye, and chum salmon and steelhead trout. Columbia River salmonid stocks contribute coastwide from

Alaska to California to the extensive ocean commercial and sport fisheries. In addition, they contribute to important commercial and sport fisheries in the river. There are also significant commercial fisheries in the river for shad, smelt, and sturgeon. Average annual commercial landings for these latter combined species during the period 1955 through 1964 are approximately 2.2 million pounds. To illustrate the magnitude of the shad population alone, more than 600,000 of these fish were counted over Bonneville Dam this year.

From the fishery standpoint, the Lower Columbia River is important for a variety of reasons including: (1) it provides a passageway for salmon and steelhead to and from upriver production areas; (2) it serves as a rearing area for juvenile salmonids; (3) it is utilized as a spawning and rearing area for shad, smelt and sturgeon; (4) it provides a fishing area for commercial and sport fishermen; and (5) it or adjacent tributaries provide a water supply for salmon and steelhead hatcheries.

In addition to these factors, the Lower Columbia River has through the years gradually attained increased importance to the natural and artificial propagation of salmon as well as to the overall production of these fish in the Columbia Basin. This is because increasing stresses on natural production upstream have led to greater emphasis being placed on better utilization of natural and artificial propagation on the lower river. At the present time, only a small percentage of former upriver production areas are still available and usable and, as upstream dam construction progresses, these represent an increasingly smaller percentage of the total production area available in the basin. However, this is not to imply that the upper river is being forsaken as a fish production area as attested to by multi-million dollar expenditures on fish passage facilities and other mitigative features at upstream projects. There are at the present time 24 governmental anadromous salmonid hatcheries in the general area comprising the lower river and its tributaries. The increased success in recent years of these facilities to produce salmon and steel head has added even more to the importance of the lower river.

Inasmuch as salmonids require higher quality water than most other fish to successfully complete their life cycle, there is little doubt that water of poor quality in the Lower Columbia River could seriously reduce or effectively eliminate these fish populations. In this connection, it is interesting to examine some of the effects of water pollution on the aquatic environment. Pollutants introduced into a stream can create the following conditions depending on the nature of the substances involved: (1) dissolved oxygen in the water can be reduced or depleted; (2) the water can become contaminated with poisonous or harmful ingredients; (3) solids from the pollutants can settle to the bottom and form layers of sludge; and (4) materials in suspension can prevent the penetration of light into the water. In turn, one or more of these conditions can have the following effects on fish and other squatic life: (1) mortality can result to adults and juveniles of the spies; (2) susceptibility to disease and toxic substances can be increased; (3) fish can show avoidance reaction and be denied migration; (4) rough fish populations can expand and compete or prey on desirable species; and (5) reduction or depletion of fish food organisms can result through the deposition of smothering layers of pollutants and/or the reduction of light penetration required for photosynthesis.

Some of these conditions have already occurred in streams tributary to the Lower Columbia River, the lower Willamette River being such an example. On this stream, dissolved oxygen levels were reduced only recently to a level where the fall runs of salmon were imperiled. This resulted from a combination of factors including high water temperatures, low stream flows, and heavy BOD loading. In this case, emergency measures to increase oxygen levels were taken which consisted of releasing additional flows from upstream reserves and requesting additional effort by industry to curtail pollution. These actions were successful in achieving the desired results. However, depending on the method used, the cost of taking such actions can be great, as can the cost of consequences if the action is not taken.

With the expansion of human population and related municipal, suburban, and industrial growth along the lower Columbia River, it is inevitable that water quality problems will continue to develop. Other factors, also, will add to and greatly complicate the task of maintaining good quality water. For one thing, thermal pollution from the possible development of additional atomic reactors and other industry along the Columbia River poses a definite threat to future water quality. Further, the anticipated changeover of mainstem Columbia River dams from the production of firm power to peaking schedules relative to the northwest-southwest power intertie may change the entire flow regime of the river with consequences presently unknown. There is also increasing interest in the possibility of transferring water from the Lower Columbia River to the southwest. If water volumes were lowered in this way, effluents could have greater effect than ever in polluting waters of the lower Columbia River. The fact that potential problems of this magnitude exist completely rules out any slackening of effort in planning ahead to overcome them. We who are charged with maintaining the fishery resource think it is none too soon to take every action possible to assure good quality water in the future. There is no longer any doubt in our minds that the survival of the anadromous fishery resource of the Columbia River is at stake due to a combination of reasons, including pollution.

In conclusion, the Fish Commission of Oregon has reviewed the report on Pollution of Interstate Waters of the Lower Columbia River -- Bonneville to Cathlamet, Washington, and concurs with the recommendations outlined on page 10 for the continued correction of pollution. In addition, we urge your attention to the potential serious problems outlined in our statement. We support the program of the Oregon State Sanitary Authority, the Washington State Pollution Control Commission and the U. S. Public Health Service and offer our assistance in its conduct where feasible and appropriate.

CHAIRMAN STEIN: Thank you very much. Are there any comments or questions? If not, thank you again, Mr. Haas.

At this point, I think we will have a ten-minute recess.

(Whereupon a short recess was taken.)

CHAIRMAN STEIN: May we reconvene?

We have asked Mr. McDevitt of Boise Cascade to come back to clarify a question that has been overlooked.

Mr. Poston.

MR. HARRIS: Mr. Chairman, I think Mr. McDevitt is out of the room.

CHAIRMAN STEIN: Here he is.

MR. McDEVITT: My initial inclination was to leave, Mr. Harris, but I didn't follow my better judgment.

CHAIRMAN STEIN: I think he is going to make a substantial contribution to the record.

Mr. Poston.

MR. POSTON: Mr. McDevitt, it seemed like we left some loose ends with regard to your proposal for treatment of your waste sulphite liquor -- in other words, your reduction of BOD.

You have seen the recommendations of the Public Health Service in that regard, and I would like to have you comment whether you feel these requirements can be met, whether our dates are realistic.

MR. McDEVITT: Well, Mr. Poston, gentlemen, in our report that is on the record, we indicate that we are and have been conducting negotiations with the Washington Pollution Control Commission for a permit for the Vancouver Pulp and Paper Mill, which is the only facility of ours on the Lower Columbia River to which your question would pertain.

Within that permit negotiation, we have negotiated in terms of and are in agreement in terms with the state of Washington on a 70 per cent reduction of the BOD loading into the receiving waters of the Lower Columbia.

Part of our problem is that of timing. I think the timing contained in the August report, which again is a new approach to us, is unrealistic for a mill on the Lower Columbia River, sulphite mill; that the engineering and construction time from our experience -- and we have built several mills -- is beyond that which you indicate as a completion and operational time in your recommended dates. This timing, I think, is going to be in all probability the key question here, and we feel that you are unrealistic by at least two years.

MR. POSTON: In other words, in 1969? We recommended it in '67, I believe by the end of '67, and you would say by January 1, 1970, would be more realistic?

MR. McDEVITT: Yes, sir; and this is the general area of time with which we have already been talking, even prior to the August 27th report, with the Washington Pollution Control Commission, although no definitive agreement has been reached to date.

CHAIRMAN STEIN: That is on the BOD levels?

MR. McDEVITT: Yes.

CHAIRMAN STEIN: There is no disagreement on primary treatment and settleable solids?

MR. McDEVITT: No, sir. I will stand by the statement that says 1967, which is our commitment to the pollution control authorities of both states.

CHAIRMAN STEIN: Thank you very much, Mr. McDevitt. Are there any other comments or questions?

Again, I would like to call the attention of the audience to the cooperative attitude that we have always had with the pulp and paper industry.

Mr. McDevitt very generously came back to answer the questions, and I think in our society, as long as we have this kind of give and take and exchange of views and information, I am sure the democratic processes work so we come out with an equitable solution.

Again, I want to commend Mr. McDevitt for his cooperation here and say that, as far as I know, this is rather characteristic of the pulp and paper industry, because while there may be differences of opinion and points of view between us and industry, I think we have never hesitated to meet together and freely exchange views and try to work out, as far as we can, a solution based on common ground.

Thank you again, Mr. McDevitt.

Mr. Spies.

MR. SPIES: Next I will call on Mr. John Wilson, Secretary of the Columbia River Sportsman's Council, to make a statement.

MR. WILSON: Mr. Chairman, I wish to preface my remarks here with a short comment; and, that is, my group has taken the viewpoint that the pulp and paper industry is not the pollution problem, per se, but it's recognized as the major contributor in volume. Therefore, my remarks are general.

Mr. Chairman, members of the Conference: We welcome and appreciate your convening of this Third Session of the Conference on pollution. We thank you for the opportunity of appearing here before you today.

My name is John G. Wilson, Secretary of the Columbia River Sportsman's Council, and I reside at Apt. 52, 2346 Northwest Glisan, Portland, Oregon.

I appear here today to represent the Columbia River Sportsman's Council and express some of our views and recommendations or suggestions that we have, relative to the matter before this Conference. The Council is composed of delegates drawn from various sportsmans' clubs in the area who periodically meet to consider problems affecting our natural resources within the Columbia Basin.

We recognize that there has been practical and progressive moves made by segments of industry and certain community areas to prevent pollution of our streams and to properly treat wastes and effluents. This is to be commended and is certainly a step forward for the health and welfare of our citizens.

However, on the other hand, there are those segments of industry, agricultural and community areas that have not, in our opinion, initiated or assumed the responsibilities as they should for control and prevention of pollutants entering our water systems. This lack is a force working against the best interests of our citizens relative to their health and welfare.

Furthermore, as we take a long-range look at this problem we can recognize that the failure to act and enforce properly during the present phases of controls and water usages is a detriment against industry itself -- whether admitted or unadmitted -- as, through new and coming industrial development, we are approaching the day of multiple process and consuming use of the same units of water drawn from the same streams.

Our Eastern river systems offer living examples of this multiple use of waters and by the lateness of their hour provides lesson examples of the high cost of process water treatment for industry and quality treatment for communities.

The hour on the Lower Columbia and its tributaries is still young according to the sands of time but is fast running out and the necessity and the need for your various authorities to initiate and to enforce the programs which will give us the base for clean waters of the future is now.

In the past years our cities and our industries settled and developed on the banks of our rivers and our bays. There was then more than enough water generally to carry away or to nullify by dilution effects the wastes and effluents dumped uncaringly into the waters. The habit of pollutant dilution became firmly entrenched.

Today these same polluting sources have grown to be huge interlaced complexes. Today, there is more pollution in volume to manage and more often less stream volume as water withdrawals and uses increase.

The Columbia River Sportsman's Council favors and supports prevention and prohibition of river pollution. We do not favor the dilution of pollution. This is the direction we point out and request of you to be pursued.

As part of the base for establishing control programs, modern management methods should have the use of standards as a tool to build with. This will be important into the future in regard to water development and usages. It is currently a subject of the national Congress. Why has not industry, community, and each of the several states of the Columbia Basin, resolved this in harmony before Federal programs take precedence?

We recommend that water quality standards be definitely established with regard to stream system drainages where not federally controlled navigable waters or interstate waters by the state involved. However, we recommend that water quality standards for drainages or basins forming interstate water systems be established by the Federal Government.

Regarding the criteria of water quality standards we remind you that we favor the approach of prevention and prohibition of pollutants released into our waters.

We recognize that cooperation between industry and state has immense value. However, we also recognize that there has not been the desired plane of cooperation. There has been a woeful lack of voluntary improvement in many instances.

It is our suggestion that a meaningful exploration of tax-relief measures on industrial water quality installations be made. This is in regard to treatment installations for process waters and sanitation wastes only. None of this should be applicable to the general plant installation itself.

The above installations should be controlled under the authority and licensing powers of, Oregon for example, the State Sanitary Authority.

There are severe examples of delay upon delay by some communities in developing and placing into service sufficient and necessary treatment plants for domestic sewage. Some of the delays are due to varying means of financing. Sometimes citizen reactions defeat an immediate purpose.

As we believe that the health and welfare of the citizen is one of the highest of service priorities it has come to be the thinking of some of us that perhaps more attention and more state financing of pollution control programs may be necessary.

Discussion has been raised in the Council that perhaps all the state expenditures are not truly in the best interests of all citizens. That perhaps a little examination may show opportunities to reduce some funds expended and apply those monies to a state aid program for pollution control plus an increase to the Authority.

This point of thought is offered to you on the basis of real priority needs to the health of the citizen.

We recommend to you that separation of storm drains from domestic and human waste systems be accomplished as soon as practicable. This will allow the full development of treatment facilities for domestic and human wastes.

We are not fully satisfied with the enforcement of our control programs. You can readily see the fast rate of development along and near our waters.

Whether control regulations are Federal or state, it should be recognized that to proceed orderly into the future we must be in some ways severe today. This is the time that establishment of the meaning and purpose of enforcement must become clear to all. Perhaps a few toes will be hurt temporarily. What is in the best interests of the citizen must be the guide, not how easy is it to grab another dollar profit for the several and at the expense of the many.

Occasionally you spank your own child so that he may learn and profit therefrom. If a violator of our waters should be spanked, then spank him.

In the long run, industry or community will also profit thereby when each through his own intake will with confidence use the other's waste water and still find it clean for his own use.

If the various proposals you have heard today and the thoughts the Council has expressed here are resolved, it is our belief that our fish and wildlife resources will be highly benefited.

If we can make effective the principle that each water user must return the water in as near a pure state as possible, then we will have clean water for man, fish, and wildlife.

Thank you.

CHAIRMAN STEIN: Thank you, Mr. Wilson. Are there any comments or questions? If not, thank you very much, sir.

MR. WILSON: Thank you, Mr. Chairman.

CHAIRMAN STEIN: Mr. Spies.

MR. SPIES: Next I will call on Mr. William Westerholm, Executive Secretary of the Columbia River Fishermen's

Protective Union of Astoria. I believe that Mr. Westerholm speaks for this organization for both the states. Is that correct?

(No response.)

MR. WESTERHOLM: Mr. Chairman, members of the conferees: My name is William Westerholm, Executive Secretary of the Columbia River Fishermen's Protective Union. Today -- well, I should say, our organization is composed of Washington fishermen, as our members, so therefore, I will be speaking for the Washington side of the river, too.

And, also, we have another speaker after I get through. Is this permissible at this time ----

MR. SPIES: (Nodding head.)

MR. WESTERHOLM: -- for our organization?

One of the fishermen's interests on the Columbia River today is the abatement of pollution and the warm water situation. Statements by our organization have been presented before at the Conference Session of 1958 and 1959, and this statement is from 1959 to the present. We also presented a statement to the Congressional Hearing in Seattle, Washington, November 22, 1963.

The pollution has shown very heavy at times but also cleaned up when the summer freshet flushed the slime out to sea. It showed in the ship channel with most of the concentration towards the shallow water. This is still within the ship channel. The slime or pollution problem at times would show on Thursday, Friday and Saturday of the week and then on Monday would clean up again. In May of 1964, the pollution was worse than in the year prior of 1958 We are aware that some mills have worked hard to solve this pollution problem as building the lagoon system and others burning their material, with progress at hand to produce more pulp; no doubt the BOD also has been increased. This is very serious as dry years with smaller flows of water means less dilution. We also note, too, that the "Thirsty South" wants the water, and if this should happen, then the pollution problem would be real serious. With the Camas Lagoon System on Lady Island, the slug that is returned to the river does not flow completely through the river, but creates new growing slime near Mayger, Oregon. This new slime prior to the Lagoon System, was not detected in this area, but could mean more dumping of effluent from other mills along the river including the Willamette and the Cowlitz River with the latter showing green, mossy slime.

The fishermen's livelihood has been seriously affected due to the heavy concentration of pollution during the fishing seasons. Along with the pollution of pulp mills, there are the municipalities along with many other kinds of mills which allow their effluent to flow into the river. One incident occurred this spring when the Spring Salmon had accumulated chemicals into their system which made them very odorous and undesirable to have in the house, let alone to try and cook them.

The Oregon Sanitary Authority and Washington Pollution Control should be commended for the work that they have done, but should be more severe on the enforcement laws enforcing laws that have been enacted by Legislatures to provide for clean water. We are in favor of the states not to issue permits for not more than one year at a time. To give a 5-year permit is too long to do anything to be accomplished. It is essential to solve this problem as soon as possible. The fishermen have been waiting upwards of 35 years for this slime problem to be solved. Since the conference sessions of 1958 and 1959, it is astounding to see that the pollution problem is still with us, and at times worse than prior to 1958.

Then we also have the warm water situation. We realize the dams do create higher temperatures on the Columbia River, and in the past years the temperatures at Bonneville Dam have been in the range of 70 degrees in the month of August and September, and with the millions of gallons of warm and hot water being allowed to be discharged into the streams by industries would, therefore, no doubt create the increase in mean river temperatures.

The drag boat "Trask" leaving Astoria August 26, 1965, logged water temperatures of 72 degrees at Astoria and did not drop into the sixties until they reached the anchored Light Ship 17 miles at sea from Astoria.

That's it.

CHAIRMAN STEIN: Thank you, Mr. Westerholm. Are there any comments or questions?

Mr. Westerholm, I know you have waited patiently on the slime problem. I think some of us have, too; but again -- and I ask you this to work on this together, because I think we are all in this together -- we know much more about slimes now than we did back in '58 and '59, I think, and I am not sure we know all there is to be known about slimes yet, as I think if you read the Federal Report it says, "If this doesn't work, other methods will have to be considered."

Now, I think it was indicated first that certainly back in the days of '58 and '59, we did not place as much count on the fibers that we do now. The thought was that the slimes formed on growths on the banks or on the islands and broke off and got into the stream. I think as was indicated, Mr. McHugh and several others have pointed to fibers and other solids in the river showing the base for the slime growth, and this is the part of the technical base for the problem.

Now, when I say this -- I think I like to see a river as cleaned up as anyone -- but I think what we have to do is deal with specifics and be sure we are dealing with specifics in getting at the problem. I do think we have made progress on the Columbia River. I think from a bacteriological point of view, the lab pointed out considerable progress has been made and the river is in fairly good shape.

I do think, though, that we all have to recognize that we have to think in terms of getting an equitable and reasonable way to deal with the problem, in order to handle the slime problem. I think -- at least our technical people have told us -- that, but for the pulp mills, you wouldn't have a slime problem in the Lower Columbia. This doesn't provide the answer. Anyone can clean up a pollution problem by closing up an industry or abolishing a city. This isn't the way to do it. The challenge is to keep the industry going, your industry as well as the pulp and paper industry, and try to come up with an answer. I think our people do; hopefully, I think they are beginning to see light and think they have a remedial program which can deal with the slime problem.

I do think that the Crown Zellerbach Company certainly -- and we and the states concerned -- went into the intermittent discharge program in good faith many years ago with the hope that it would work.

Now, on reevaluation, we have seen the effects and we recognize that we have to do something more to meet the slime problem.

Again, I say in pollution control, when you do not know the specifics -- I'm not sure we have everything nailed down here yet -- don't expect magic results.

I remember just about maybe six months ago, a lot of the conservationists were at a loss for one day, were very irritated about something I had said in the lower Lake Michigan Conference up at Chicago. They had complained about the tremendous death of airwives -- which are fish up there -- and loons; and, the cause of these deaths, as far as I know, is still a matter of conjecture and unknown. I pointed out that the pollution control measures that we were advocating up there -- and this was unanimously agreed by all the states, were about as rigid as we have anywhere in the country, very, very tight pollution control measures to protect the waters of Lake Michigan -- but I pointed out that the people should not be assured that this was going to stop the airwives and the loons from dying because we had no notion that pollution was their cause; and they got excited for a day, but I think after they realized the situation, they subsided.

I think, in a rough analogy, we may have had this same problem with Sphaerotilus just because we have had scientific problems with us much longer than 35 years. I am not saying that -- maybe we could, maybe we couldn't -- if we had a tremendous crash program like putting a man in space, building one of these tremendous bombs -- we couldn't have got an answer to the Sphaerotilus problem sooner. But I think, as soon as at least the Federal Government had the new knowledge on the Sphaerotilus problem, we tried to come forth, as we are here today, in trying to put that into effect.

Now, I know the fishermen, when you get the slime in your net, that isn't the answer. The question here is that you can't expect us to ask anyone, whether it's a city or an industry, to do a futile act which isn't going to help your problem anyway. We want to be fairly sure when we ask them to engage in a course of action, that that course of action will result in an improvement of your situation.

Now, I have one other question to ask, and I'd like to ask the conferees: Is heat really becoming a pollution problem in the lower river now?

MR. HARRIS: I believe it is, Mr. Stein. It's becoming more and more important with the more dams we get on the river and the general raise in temperatures.

CHAIRMAN STEIN: Here's an assumption of your statement, Mr. Westerholm: You talk about hot water being allowed to be discharged into streams by industry. Now, except for dam-associated industries and power plants -- and I don't know that that has any effect -- or perhaps a nuclear reactor, I think we should really see how much effect industrial water really has on raising the temperature in the river. If this is a problem, again, -- and I talk to you about this because the thermal pollution problem may be easier to trace, because what you can do is trace temperature and trace where it's coming from, but I don't know whether we can make assumptions on what the causes of the heat rise are until we begin to look at the sources. And I suspect, with Mr. Harris, we may find all those dams on the river being mainly the answer.

In other words, what I am saying is I am not sure that the raising of the water is due to industrial use largely, but I can assure you that if it is, and this is a pollution problem, we will get at it, and this may be something that the conferees may wish to consider and we may wish to analyze in the Lower Columbia River if this is becoming a severe problem.

MR. WESTERHOLM: There is one other statement that you brought up on this pollution, as they are allowed to be diluted in the Columbia River. In other words, they're allowed to use the Columbia River for multipurpose use. We have been waiting for 35 years, and right today I have also known it, saw it in the paper, where the mills are coming back and asking for two to five years again. We have been -- for 35 years, they have always given this same thing: "Just give us five more years and we will straighten it out."

CHAIRMAN STEIN: I don't think we are at that stage now. As I understand, we haven't heard from all the mills yet, Mr. Westerholm. The point is -- let me get back to the original point -- I think this is expressed in the Federal Law. We do not believe in dilution as a solution for pollution. We believe in correcting pollution at the source It is only when all reasonable efforts have been made to correct pollution at the source, and you do get periods of low-stream flow, that in order to tide you over, you may need augmented low flow during that period. This is not to be a substitute for adequate treatment of the source but only if you still have a problem because of low-stream flows after providing adequate treatment.

Now, I think the issue, as I have heard it before in talking about two more years and three more years or five more years or whatever time it is to develop a program, I think the Federal Report now has come up with a very, very specific program: primary treatment, settlement of the solids, and a reduction of the BOD loadings by 70 per cent.

I think that the argument here or the statements that I have heard here -- probably "argument" is probably not the correct word -- but the issue here goes with the reasonableness of the time to accomplish this. In order to accomplish any kind of construction or any kind of planning, you have to have your time for planning and construction. The analogy we can use, is, you may say you're going to buy a new fishing boat in three years more or five years and never get around to buying the fishing boat. But once you decide to buy the fishing boat, supposing you put in your order, you have to give a reasonable time before you're going to get delivery; and I think the time we are talking about at this conference, sir, is just a reasonable time to have the construction of these facilities. We aren't talking any longer about the possibility that someone might do something.

The issue here is a reasonable time for what people are going to do to take corrective action.

MR. WESTERHOLM: Well, that's all I have got to say. There is only one more thing that you bring up about the man to the moon. I think we should go down to Florida and divert that money up here, solve the problem up here, before we send the man to the moon.

Our next speaker will be Mr. Puustinen of our Conservation, legislative chairman of our organization.

CHAIRMAN STEIN: Mr. Westerholm, I don't want to be funny about this. In all due respect, I am not arguing with that last statement of yours, but I suggest you are addressing that to the wrong forum. You really should tell that to the Congress and not to this panel of conferees.

MR. SPIES: Mr. William Puustinen.

MR. PUUSTINEN: Mr. Chairman, conferee members, ladies and gentlemen: I am W. William Puustinen, chairman of the legislative and conservation committee of the Columbia River Fishermen's Protective Union. I reside at Springfield, Oregon, on the lower McKenzie River. I have been a commercial fisherman for over 40 years, and I have learned, as a layman, to observe certain things in the fishery.

I have also come in contact with the technicians of the authorities in the management of the fishery for the state of Oregon, state of Washington, state of Idaho, and for the United States through the Bureau of Commercial Fisheries, so I have learned a little from these technicians and the scientific men of these staffs of these various organizations.

What I propose to present to you are, then, thoughts and suggestions as I have found them as a layman in my experience through the 40-some years in the fishery in my position as a commercial fisherman.

I have some rough notes here that are not complete. I would like to read some as I go and expand on others as I may see necessary, and then lay myself open to questions as I finish.

The commercial fishermen, food fishermen of the Columbia, wish to file with you the following statements in regard to our work and observations to date on river pollution control in the Columbia area. The Columbia River Fishermen's Protective Union first sought legal recourse to clean up pollution threatening our fisheries by instituting court action in 1933 against 111 named industrial and municipal polluters of the Columbia. That was 32 years ago. Our union has records of trying for a voluntary pollution cleanup many years prior to this first legal action. It is interesting to note that in our first trial court in 1933, that court held that the Columbia River Fishermen had no legal grounds for complaining against the river's pollution.

This is a strange commentary on the trial court's position at that time, when it is realized that we, like the farmer, were and are engaged in the harvesting of food products for our general public, foods that certainly should demand priority for cleanliness in growing, harvesting and handling.

It was only later when Judge Peters of the Oregon Supreme Court wrote an opinion reversing the trial court, that the commercial food fishermen of the Columbia were legally sustained in their contentions that they had legal grounds for asking for pollution control on the Columbia.

Since then our work has been constant to following 32 years trying to get voluntary and local government action to clean up the Columbia.

We have seen the final popular sanction in the state of Oregon for the Oregon Sanitary Authority with legal directives for the controlling and abatement of river pollution; yet 32 years have we seen slip by and still the Columbia River is polluted, even worse than in 1933.

It is obviously clear that we are not keeping up with the increasing industrial, municipal and other developments to date with our river pollution control work in the Columbia River area.

Therefore, the commercial food fishermen of the Columbia wish now to ask for the proper forbearance and understanding of all parties -- river polluters and pollution enforcement authorities together -- for our frankness and perhaps bluntness in this statement. After all, we are pleading for cleanliness not only for our own personal considerations in the course of our fisheries work, but we must also demand that our food products be accorded the same high esteem of cleanliness we accord any other food products from the farmer's own land.

We wish to point out that there have been all through the 32 wearying years past, altogether too much negative consideration from almost all local industrial concerns and from many municipals also.

It would be nice, we suppose, to go on just generalizing in this vein and still hoping to have the obviously needed right decisions made voluntarily by the polluting parties. But let us -- in the midst of a sudden storm we have found that action is needed, not quiet contemplation in the crises. Thus, we must become particular in our observations, in our suggestions, after this many years of the most frustrating kind of experience in trying to enlist voluntary cooperation for our river pollution abatement.

In this mission of the polluters, we'd like to mention that in the municipals we are not satisfied with the city of Portland at the top of the Oregon-Columbia Basin municipals. To us the efforts of the city of Portland to satisfy the pollution control needed for our fisheries alone has been some sort of monkey business, because, in fact, most of the work for the city of Portland to us seems to have been merely arranging to dump the sewage that was originally dumped on Portland's front doorstep, so to speak, in the Willamette system, now is being dumped to other pumping systems more to their back door, in the main Columbia.

Somehow that seems to be the same for the lower Willamette system industrial plants, and in our mind we are not solving very much in that respect.

I would like to diverge a little bit, not because I want to get afield, but because there is a specific bearing of an industrial plant on the upper Willamette River that might suggest very accurately what we, as fishermen, hope could be attained through pollution control and what we, in the fisheries need to keep our resource intact, and upon which base we would then go ahead and develop it and rebuild the fishery back to the former volumes that we know were on record and which fishery, on the basis of those records available, could be expected under the proper management today, proper scientific aids as we have them, to be even increased perhaps severalfold over the original maximum volume the Columbia produced fish as it did years before pollution.

I would like to say that of all the industrial concerns and all the municipals, we as fishermen have found no one that has given us more interesting hope than one concern on the McKenzie -- the Weyerhaeuser plant on the McKenzie River. I say this because from the very first instance of pollution on the McKenzie, we as commercial fishermen were probably the most bitter critics of the Weyerhaeuser Timber Company because of the pollution of the McKenzie, one of the finest salmon streams left in the Oregon system of the Columbia.

Yet, after getting together with the people of the Weyerhaeuser Timber Company, we did find finally that there was cooperation developing. It went through on several years, and through that cooperation of a very bad pollution condition on the McKenzie -- it was really terrific -- we had found that pollution being cut down, cut back, curtailed, taken care of, to the degree that I, over the experience of the years having learned to judge natural conditions in the river to the best of my layman's ability, thought we were beginning to approach the margin of possible maximum or realistic fishery control for an industrial plant's pollution.

That went along to the point where, to show you what I mean, the Weyerhaeuser pollution, from the thick, foamy dark fluid outflows, full of fiber and solid material going down the river like bran mash in the morning, as we went down to the river to see it, decreased to the point where the original blue-green color of the McKenzie was, months on end, even during the low period of the river, where the gray-like and sludge cover the rocks up to five and six inches deep of my own property on the McKenzie, we found that sludge to have disappeared and to become replaced in the low water stages by green algae, green filamentous algae that at times I myself have seen,together with the men from the Game Commission and the Fish Commission staffs; the aquatic insects were moving through this filamentous algae very freely; and the reason I bring this up is that this doesn't mean a heck of a lot to me, to just show me water below an outfall from anybody's industrial or municipal plant, show me a fish swimming in it unless you can show me that that water is as natural-like as it was before when the fish that needed food also found and do find the aquatic organisms on which they feed.

So we have to go farther than merely having water clean enough for fish to swim in. Over the years I have seen what I have seen through the fisheries; we need fish not only to have a clean sand pasture to pass through; we need to have one that is fertile with food, for those fish to survive on, because the little fingerlings after they are born must have food to live on, and so in order to have the chain complete, we need to know from the upriver points there on down to the Columbia to which these upper points contribute their effluents, we need to know this picture to be complete so we need to have a chain of energy in the form of aquatic food life available for the young fish clear from the upper streams on through their lower tributaries, through the main Columbia and on out to sea, so that the course of the fish from the natal gravels clear to the ocean is intact and provided with the necessary foods.

If I can remember now -- this may seem to be diverging off the point -- but I can remember when the Lower Columbia itself had teeming insect life in the form of May flies that we call salmon flies. Those same salmon flies are yet to be found in the tributaries above the tidal areas of the Lower Columbia; we find them on the Upper Columbia. Those same insects were so thick -- they were large May flies about two and a half to three inches in length from head to fork and tails -- they were so thick in the summer evenings at this same, very time we are meeting here now that the sea gulls, large birds as they are, chose to feed on them the same as swallows feed.

There were times I can remember myself when those sea gulls by the dozens and dozens would just come swooping through the air picking up these flies. Go down there, gentlemen, to any part of the Lower Columbia, see if you can find one single one of those May flies. Yet you will find them in the backwaters away from the tidal area, in the tributaries. To me this means a very important consideration that we have forgotten to look into.

If the Columbia River had myriads of insects and aquatic life of various kinds to feed the fish, and if it does not have that abundance of life now, how can we under any consideration expect our fisheries then to provide the fish or the missing chain between the natal gravels and the ocean unless we put bought or purchased food into that stream ourself?

That is the picture I'd like to inject in here from a biological viewpoint. I would suggest that it bears a great lot of research so we will know the exact fact, of how much aquatic life of this type we need for our fisheries, how much expanded fisheries we can ever get to expanding will demand, and how we should handle it to get the best maximum results.

As I say again, I am not a technician; I am not a biologist; I am not an authority on that basis at all. But as a layman, I have seen this picture change from one of abundance of insect life followed by decrease in the fishery, not only by pollution but by many other factors, but certainly pollution has been one of the factors, and I think that the pollution alone or pollution working alone on fish has not been responsible; it has been also responsible for depleting the resource by working on the aquatic organisms upon which our fish feed.

Another picture, in completing the picture of the Weyerhaeuser Timber Company up on the McKenzie, it gave us great satisfaction to watch the progress of the cleanup of their pollution; and up until two years ago, I am personally satisfied that we would have very little more to go until we would have had practical realistic aquatic life included type of pollution control for the Weyerhaeuser Timber plant on the McKenzie, and if we had it on the McKenzie, we certainly could have the same type of work anywhere else, on the Columbia system or anywhere where salmon fisheries were.

However, I must for the record, then, make this additional correction to the picture to date: We did not have complete consistent control even in the years of the best control that was exhibited by Weyerhaeuser. There were breaks as can be expected -- sometimes technical, mechanical, sometimes by personnel failures at the concern. I don't know which. I'm not in the position to know. But I do know that the breaks occurred, and they were reported from time to time through the company officials, also the State Sanitary, Fish and the Game Commission, so forth.

Last summer we had a very bad break again. This was due to extra pressure and conditions brought about by the increased redoubling of the capacity of the plant, problems involved thereto. There was a very bad break occurred on July 18th. I want to bring this in not to downgrade the efforts of the Weyerhaeuser Timber Company, but to show you another vital angle that we as fisheries must face. When this break occurred, it had more or less the same effect on our fishery from that point on down through the McKenzie on down into the Willamette system. How far down, I do not know, because I have no way to check it or had no one in any other authoritative position to check it, so we do not know how far this effect carried; but if that water at the time it left Weyerhaeuser full blast, with all the pollution in was toxic enough to kill fish back there in the early years, which I know it did -- we counted the dead fish then by authorities, by the Game Commission, Chris Jensen being one of them -- if it was toxic enough then, it could have been toxic enough at this time to create quite a lot of havoc among fish themselves and certainly among the more delicate aquatic organisms upon which fish feed. How far down that river that swept, I don't know, but it would have the same effect as a fire going through the weeds, destroying the bird life, nesting birds, so forth, for fire going through the forest killing the trees.

To us, even one break of one hour's duration, being toxic enough to go down the river, riverwide for miles on end, can be just as bad as if you have no pollution control whatsoever for several months preceding, because suppose, now, that, theoretically, we have perfect control on the McKenzie, and as of the time of the laying of the salmon eggs on the gravels last fall, just beginning soon, within about a month, would be a period of the spawning of the McKenzie salmon -- supposing everything was perfect from then on through until July 18, and that toxic flow of July 18, if it was as toxic as it might possibly have been, went through and wiped out the aquatic life and all, we in the fisheries could have lost that whole segment of that year's cycle run for that area. That's as critical as it is for us. And that's why we must then be so blunt to bring these points out, not in charging sensational charges against anyone, whether it be Weyerhaeuser, whether it be some of the municipals or industries down the Lower Columbia River, but at any one of these points, at any one of these critical time periods, our resource can be wiped out in the segments -- one segment here, one segment there. And we have Lloyd Royal, one of the Northwest's noted salmon biologists -- it is already his thinking that the Columbia River is lost to the different destructive agencies, over half of the races of different salmons that were originally here on the Columbia Basin. We can't afford to lose the remnant stock, or we must choose to answer a question which I am going to ask you before I close again. If we are going to go ahead and just chisel away on the fishery resource, which is not only my resource as a commercial fishery; it's yours, it's everybody's of the United States. It's just . as much the public resource as the timber, as agriculture or mining or any other -- if we are going to just by quiet acquiescence in one way or another, just allow the fishery to be chipped in here, chipped in over there, chipped from the other side until there is nothing left, then let's be honest enough and make this stand bold and public. We are going to give up the fishery resource, commercial and

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recreational, before God and everybody, before the American public, and we will say so and do it with each and every one of us all together, not blame it all on the commercial fishermen or their agencies who are trying to save it against these many various odds, all over the scene, that are hedging in, closing in, cutting in, curtailing our efforts in so many different ways.

So you see, we aren't in a very particular position. We have pollution, we have dams, we have various fishery agencies and others that are working -- some few for us, but many being in contact with the water that we use -- then having their fields to work in most often are in the position to damage us before they realize it even themselves, perhaps. So we are rated; we have a rate against us in a multitude of destructive agencies and factors, and we alone are a very small minority group and force trying to offset it all.

That's why we ask you for your forbearance and your forgiveness if we should be blunt, because we haven't time enough any more to temporize; we haven't time enough to ask for leniency in some of these cases.

Now, I would like to suggest a second point of research that we think we should do in the lumber and timber area. This is in the matter of log raft immersion in the rivers along the main Columbia in particular. I see acres and acres of logs floating, sometimes at anchor months on end, some, rather, I know have been over there at the same anchorage for years. I don't know why. I would like to suggest we find out just how much contribution to the river pollution do those log rafts contribute from the moment they are dumped in at the log dumps and their bark sluffs off and the mechanic acids and the other acids from the wood tissue begins to leach into the waters. How much contribution to the river pollution does a log raft contribute? And we could easily find that out by research. That would take care of the different species of trees being dumped into the river and during the different seasons of the year.

We have the summer season when a bark very easily is knocked off the logs as a soft pulpy sap growth on the surface tissue of the wood. Certainly there is a difference in the amount of sugars and polluting materials from the log that will go into the water during that time and that kind of a log dumping than it would be in the winter, but I don't know. I would suggest we have a research to find that out, if it might be a considerable factor of pollution right there. And it might be well to find some ways to handle that quite readily and not be in a position then to blame all of that pollution on the mills. It might be that the mills have a little less pollution to take care of than we had thought in the first place.

Then, in summing up the picture, I would like to say that we have been written down as a very small volume of industry. Yes, we are not very big now. Let's look back in what records we do have. We don't have very many right there. I'd like to diverge enough to put this point up, and any one of you who are attorneys will recognize the very bad position to which the fisheries are put there.

When we are before a hearing of experts, we are asked to hold to the facts as recorded. Let's look at the facts that the fisheries have on hand. It takes four years to five years of study on one single cycle basis to get even one dot that you can graph on a line, following the history of any of the fish runs through from nativity to spawning period. It takes, then, fifteen to twenty years to get five, or get three or four or five dots on the line according to what cycle runs you have. You can't expect to get any kind of a meaningful graph at least until you have a good many dots on the graph, to represent anything. We are up against a very different problem of getting facts recorded in time to meet these developments that are hitting us year by year in increasing numbers.

All you people in the industrial end have to do is take a slide rule, start making out your decisions on the basis of your findings as you have them at hand, and apply the slide rule; you have got a picture here that is quite definite for the future. You can present quite a definite picture; we can't. We are stuck with something Nature just put up against us if we can't handle it that way; but, nevertheless, even realizing the very hard position that we are in, we know that the Columbia River produced in 1883 alone, the highest year of its production of course, 640,000 commercial cases of fish -- 640,000 full cases; that means 48-pound cans to the case, not the original or the case we speak of today with 48 one-half pound cans.

Now, if we remember that in 1883 we fished only in the months of April, May, June, and July commercially -- no other fish was taken commercially in those years -- then, if 640,000 cases was some sort of a measure of the capacity of the river under natural conditions before pollution, before dams, so forth, for April, May, June, and July, and later when we begin to fish August and September, after these four months runs have been hit by various factors and decreased -- we found that our heaviest summer fish was actually in August and September -- then it's very reasonable to assume that at least more than double 640,000 cases could have been a heavy, maximum yield of the river in its natural condition prior to man-made destructive agencies. Maybe the 12 months' period would have given us a 1,500,000 full cases to the year, to the Columbia. I don't think that's an exceptional guess at all; I'm just leaving those figures for your own consideration.

Suppose, then, that we take any figure from today's values of near 30,000 -- $30 a case for a full case of halves, fancy Columbia River salmon -- use $20 a case figure, what would 1,500,000 cases of Columbia River salmon amount to today under the original natural productive capacity of the River before white man came in and spoiled it?

We have today found in our hatcheries that we can hatch 80 to 90 eggs out of every hundred taken, where under Nature it was a heavy successful hatch if you got 20 eggs out of a hundred, for a potential of four and a half, by the eggs of a modern hatchery business.

We have found that by the food pellet system, developed by Oregon State Agricultural College and the Fish Commission and the fisheries agency, we have learned to rear silver side salmon now in the lower river tributaries and in the waters where they are still able to find somewhat natural-like habitat, we have been able to produce those back, several times back over the ones that the volumes that were running just a few years prior, again suggesting another heavy increase in potential.

Then, I ask you, is it possible that if we had all the potentials reasonably utilized and all the consideration for the fishery given in the same form that you people in the industries and you people in the municipalities asked for your parts of the picture of this society that we are living in, might it not be possible to have 200 million or more in fisheries value come out of the Columbia in commercial and recreational values in a year?

If you had 200 million, I think you gentlemen would think a whole lot differently whether you want to give up this fishery by just letting it slide by under default practices, as I see them now.

And that, ladies and gentlemen, and Mr. Chairman, is what brings me to this final question, as I said before: If we are going to want to give up this fishery resource and want to think about our industries in the other forms as being more important, then let's not blame the commercial fishermen or the fishery authorities who are trying to save the resource. Let's all of us, in our various capacities -- municipal, industrial, and otherwise, take this responsibility upon our shoulders and say to everybody before God and all, we are going to give up the salmon resource, but let's do it publicly.

I thank you.

CHAIRMAN STEIN: Thank you, Mr. Puustinen, for a very complete report. Are there any comments or questions? If not, thank you very much.

Mr. Spies.

MR. SPIES: I will call on Mr. George K. Moorhead, Chairman of the Water Pollution Committee of the Oregon Wildlife Federation.

MR. MOORHEAD: Mr. Chairman, conferees, ladies and gentlemen: I am George R. K. Moorhead, Chairman of the Water Pollution Committee for the Oregon Wildlife Federation, and my statement is as follows:

Having followed the work of the Oregon State Sanitary Authority since its beginning, we have been firmly impressed by the progress that has been made in pollution abatement and by the consideration that has been shown for the problems involved in abatement by industries and by municipalities. Avoidance of political involvement has given the Sanitary Authority an image of integrity, unrivaled in our state government.

We realize that operation is limited by an inadequate budget and we would like to see the budget and operation increased.

We have every reason to believe that the Washington State Pollution Control Commission and Administration and the National Department of Health, Education and Welfare are as conscientiously deducated to pollution control and elimination as is the Authority of the state of Oregon.

Feeling that adequate time has elapsed for all those who are responsible for water pollution, whether they be industries or municipalities, to show definite evidence of their intention to proceed with a distinct program of pollution abatement, we believe that those who have not shown such evidence should forthwith suffer the penalties provided by law.

We respectfully request the several authorities involved in this conference to suggest procedures by which we, as individuals, and as an organization, can best serve in abatement or elimination of pollution in the Lower Columbia River and its tributaries, as well as other waters of our state.

Thank you.

CHAIRMAN STEIN: Thank you, Mr. Moorhead. Are there any comments or questions? If not, Mr. Spies.

MR. SPIES: This completes the list of the people who had indicated they wanted to speak unless Mr. Chan Schenck, Portland, wishes to be heard. Chan, do you have anything to say?

MR. SCHENCK: Mr. Spies, I think I can just state here: As secretary of the Interstate Pollution Abatement Committee, who were quite active in this in the '58-59 session, are still interested, and I have a written statement that I can submit. It will simply follow along the lines of the general discussion today.

MR. SPIES: Thank you, Chan.

MR. SCHENCK: This is from the Washington State, the Lower Columbia River Council on the Washington side, of which the Interstate Pollution Abatement was a subcommittee.

CHAIRMAN STEIN: Without objection, that will appear in the record as if read.

(The following is the report above referred to:)

"Lower Columbia River Sportsmen's Council
Wahkiakum, Cowlitz, Clark, Skamania and Klickitat Counties
WASHINGTON

Vancouver, Washington
1806 N.W. Sluman Road
September 6, 1965

Department of Health, Education and Welfare
Division of Water Supply and Pollution Control
Pittock Block
Portland, Oregon

Gentlemen:

Reference the meeting scheduled for Wednesday, September 8, 1965 pursuant to provisions of Section 8 of the Federal Water Pollution Control Act. Please make this letter a part of this meeting.

It hardly seems necessary for this organization to go into the reasons why we are opposed to pollution, nor is it necessary to enumerate the sources of pollution to the Columbia, and the possible ways to correct the situation. Your department has been studying the problem for approximately seven years and should be well aware of all these points.

In 1943, 22 years ago, there was an investigation published in 'Report on Investigation of Pollution in the Lower Columbia River' by John H. Lincoln, Chief Chemist, and Richard F. Foster, Biologist, for the Washington State Pollution Commission and the Oregon State Sanitary Authority.

Since then, with relatively minor variation on the report, pollution has flowed merrily on in the Columbia River. It is very likely if the thirty-four points made in the above reference were read today, they would probably, with slight variation, apply to today's Columbia River pollution situation.

Then in September 1958 (7 years ago) we were informed that under P.L. 660 the ground rules were laid down for proceeding in an inter-state pollution situation. Still pollution continues to flow merrily along in the Columbia and Willamette Rivers.

I have noticed that in this and other pollution situations there are two statements used that seem to postpone effective pollution abatement action. One is, 'More research and study is needed. The other is, 'It costs money.'

The point is that if there is no more corrective action taken by all agencies to abate Lower Columbia River pollution and get ahead of the problem in the next 22 years, by

1987, than there has been in the last 22 years since 1943, the Columbia will replace the Potomac River as the most polluted stream. Respectfully yours, Howard E. Nelson, Secretary.

MR. SPIES: Is there anyone else from the state of Oregon who wishes to be heard at this time?

MR. McDEVITT: Mr. Spies, I wonder if I might bear your indulgence a moment and amplify my answer to your secondary question.

CHAIRMAN STEIN: Yes.

MR. McDEVITT: It will just take me a moment.

I would like to point out that when I gave you the realistic date that we feel is realistic for the reduction by 70 per cent of the BOD loading -- and I raise this now because I am -- I intended to raise it privately, but I don't want to mislead any of the conferees that we are in that context when we talk about recovery, which we then must talk about, a recovery system, talking about a mill substantially larger than 200 tons per day. So in this context I am somewhat concerned with the question Mr. Spies raised this morning. If you are saying to me today, rather than just a 70 per cent reduction, if you are saying, "You must forever live with Table I," I say, "You can't put that type of a recovery system on a 200 ton a day mill in an economic condition that exists." And you gentlemen are then saying to us -- unless I am wrong -- that there shall be no growth in the paper industry on the Lower Columbia.

CHAIRMAN STEIN: Let me say I didn't write this report, but I didn't read it that way. The way I read the report -- and I asked the question, if you recall, when Herman Amberg was up here -- I don't know whether you were in the room -- about that Kimberly-Clark mill in California -- the report as I read it is to have a restriction based on current production, and this would be a settleable solids BOD reduction, that is roughly called "primary treatment" for your industry. If any additional capacity were to be put in, then you would have to, according to the recommendation as I read the report, have to put that through the equivalent, the second treatment, bacteriological treatment or its equivalent.

Now, when I asked Mr. Amberg why this wasn't done with the new mill they're putting up in Oregon, he said he didn't believe it was necessary on the Columbia. What was suggested in the Federal Report was this would be necessary if production were expanded henceforth.

Now, this is what I think they said in the Report.

Now, when you talk in terms of expanding an industry or economics, we do know where requirements such as that have been enforced, there have been new paper mills built and put into operation. Obviously, the margin in those areas, because of the increased facilities, is going to be a little tighter than it will where you won't have it; but I don't think that, as I read the report, this report talks about a freezing of the pulp and paper industry at all.

Is that a fair statement?

MR. POSTON: I think that's right. What we were attempting to do in making this recommendation was to put a floor on pollution -- let's not let it get any worse; let's not have 1959 continued through '65 and '70. And we are putting a floor on now.

This does not mean that you cannot increase production. It means when you increase production, you will have to increase treatment. This was our thesis on which this was drawn.

CHAIRMAN STEIN: Are there any further comments or questions?

If not, let me give you what I think will be our schedule as best I can judge, because I have no idea of how many participants Washington is going to have or how much they're going to take, unless Roy Harris wants to say so; I won't ask him the question now.

We will reconvene at 9:30 tomorrow morning. At that time, we should proceed with the Washington, state of Washington presentation. We expect that that should be completed sometime early tomorrow.

MR. HARRIS: Oh, yes; before lunch.

CHAIRMAN STEIN: Before lunch tomorrow, hopefully. That is the whole presentation?

MR. HARRIS: Yes.

CHAIRMAN STEIN: Not just yourself, but the invitees?

MR. HARRIS: No.

CHAIRMAN STEIN: Then, depending on the judgment of the conferees, we will find a way of getting together and be available, and then come forward and make an announcement.

We will announce that tomorrow; so I suspect that we should be able to wind this up tomorrow, have an announcement and a conclusion to set forth.

It seems to me, the way this is developing, if this moves along the direction that I have seen it so far, hopefully, we can come up with a solution and hopefully, very hopefully, this could be the last conference that we would have on here, and move on to a solution to the problem.

And I might say that with this, I am certainly very optimistic, because this is really the first time that I have really seen daylight on this problem here, and I think we have come a very, very long way; and, so, if you will bear with us, we will proceed tomorrow and hope to wind this up.

We will stand recessed until 9:30 tomorrow morning at the same place.

(Whereupon at 5:05 o'clock, P.M., of this day, Wednesday, September 8, 1965, a recess was taken to Thursday, September 9, 1965.)